

**Solution**

- a. First find the profit.

$$\begin{array}{r} \$72 \quad \text{Selling price} \\ -\$45 \quad \text{Cost} \\ \hline \$27 \quad \text{Profit} \end{array}$$

The profit is \$27 per calculator.

For parts b. and c., use a ratio and then change the fraction to a percent to find each percent of profit.

- b. For percent of profit based on cost, remember that cost is in the denominator.

$$\frac{\text{Profit}}{\text{Cost}} = \frac{\$27}{\$45} = \frac{3}{5} = 60\%$$

The percent of profit based on cost is 60%.

- c. For percent of profit based on selling price, remember that selling price is in the denominator.

$$\frac{\text{Profit}}{\text{Selling Price}} = \frac{\$27}{\$72} = \frac{3}{8} = 37.5\%$$

The percent of profit based on selling price is 37.5%.

**Note**

Percent of profit **based on cost** is normally higher than percent of profit **based on selling price** because the selling price is usually larger than the cost. The business community reports whichever percent serves its purpose better. Your responsibility as an investor or consumer is to know which percent is reported and what it means to you.

**Now work margin exercise 8.****Margin Exercise Answers**

1. a. 130 b. 352.4 c. 35% 2. a. \$13 b. \$39 3. \$150 4. \$41.73 5. \$2682 6. 4% 7. 3%  
8. a. \$60 b. 120% c.  $\approx 54.55\%$

## 4.7 Exercises

### Concept Check

**Fill-in-the-Blank.** Complete each sentence using information found in this section.

- The final step in solving word problems is to \_\_\_\_\_ over the result to see if the result is reasonable.
- The amount of reduction in the original selling price is called a/an \_\_\_\_\_. The reduced price is the \_\_\_\_\_ price.
- Sales tax is a percentage of the \_\_\_\_\_ price. This tax is added to the buyer's cost.
- The fee paid to an agent or salesperson for a service is called a/an \_\_\_\_\_.
- If the value of an item increases, the increase in value can be called \_\_\_\_\_.
- Percent of profit can be based on either \_\_\_\_\_ or \_\_\_\_\_ price.

**True/False.** Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

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7. If an item is selling for a 35% discount, the customer will pay 65% of the original price.
  8. If you must pay 7% sales tax on a purchase, the total cost you will pay is 170% of the total before tax.
  9. A car was purchased in 1965 for \$3800. It sold for \$1200 in 2011. This is an example of depreciation.
  10. Profit is determined by subtracting selling price from the cost.

## Practice

Change each value to a percent.

- 
- |                  |                     |
|------------------|---------------------|
| 1. 0.91          | 6. $\frac{87}{100}$ |
| 2. 0.625         | 7. $1\frac{1}{2}$   |
| 3. 1.37          | 8. $\frac{2}{3}$    |
| 4. 0.0075        |                     |
| 5. $\frac{3}{8}$ |                     |

Change each percent to a decimal number.

- 
- |           |           |
|-----------|-----------|
| 9. 69%    | 13. 0.5%  |
| 10. 7.5%  | 14. 235%  |
| 11. 11.3% | 15. 82%   |
| 12. 162%  | 16. 31.4% |

Change each percent to a reduced fraction.


- 
- |         |          |
|---------|----------|
| 17. 35% | 19. 130% |
| 18. 72% | 20. 40%  |

Use the equation  $R \cdot B = A$  to find each unknown quantity. Round percents to the nearest tenth of a percent. All other answers should be rounded to the nearest hundredth, if necessary. See Example 1.

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- |                                 |                               |
|---------------------------------|-------------------------------|
| 21. 10% of 70 is what number?   | 24. 17 is 20% of what number? |
| 22. What percent of 32 is 30.4? | 25. ____% of 34 is 17.        |
| 23. Find 15.2% of 75.           | 26. 12% of ____ is 15.        |

## Applications


Solve.








27. A television which normally sells for \$300 is priced at a 10% discount.
  - a. Find the amount of the discount.
  - b. Find the sale price.
28. A new briefcase was priced at \$275. Suppose that it were marked down 30%.
  - a. What would be the amount of the discount?
  - b. What would be the new price?
29. A store owner received a 3% discount from the manufacturer when she bought \$15,500 worth of dresses.
  - a. What was the amount of the discount?
  - b. What did she pay for the dresses?
30. In order to get more subscribers, a book club offered three books for a total price of \$7.02. The total selling price was originally \$17.55 for all three books.
  - a. What was the amount of the discount?
  - b. Based on the original selling price, what was the rate of the discount on these three books?
31. Sheets are marked \$22.50 and pillowcases \$7.50. What is the sale price of each item if each item is discounted 25% off the marked price?
32. Towels were on sale at a discount of 30%. If the sale price was \$3.01, what was the original price?
33. Headphones were on sale for \$49.00. What was the original price if the sale price represents a discount of 20%?
34.  An auto supply store received a shipment of auto parts and a bill for \$845.30. Some of the parts were not as ordered, and they were returned immediately. The value of the parts returned was \$175.50. The terms of the billing provided the store with a 2% discount if it paid with cash (for the parts it kept) within two weeks. What did the store pay for the parts it kept if it paid cash within two weeks?
35. In the roofing business, shingles are sold by the “square,” which is enough material to cover a 10 ft by 10 ft square (or 100 square feet). A roofing supplier has a closeout on shingles at a 30% discount.
  - a. If the original price was \$230 per square, what is the sale price per square?
  - b. How much would a roofer pay for 34 squares?
36. An auto dealer paid \$8730 for a large order of special parts. This was not the original price. The amount paid reflects a 3% discount off the original price because the dealer paid cash. What was the original price of the parts?
37. If the sales tax rate is 6.5%, what is the tax on an \$800 purchase?



### Why Do Bostonians Shop in New Hampshire?

Sales taxes are not the same everywhere. Different states have different sales tax rates. Within a state, different localities may have different rates. In California, for example, the 2019 minimum sales tax rate is 7.25%, but within Los Angeles County, the rate is at least 9.5% and as high as 10.5% in the city of Santa Fe Springs. At the other extreme, five states in the United States don't have sales tax: Alaska, Delaware, Montana, New Hampshire, and Oregon. And that's why people from Boston go shopping in New Hampshire.

38. The sales tax in a certain state is figured at 6%.
- How much tax is there on a purchase of \$30.20?
  - What is the total amount paid for the purchase?
39. Suppose sales tax is figured at 6%.
- How much tax would be paid on the purchase of three textbooks priced at \$55.00, \$25.50, and \$43.95?
  - What would be the total cost of all three books?
40. If sales tax is figured at 7.25%, how much tax will be added to the total purchase price of three textbooks priced at \$25.00, \$35.00, and \$52.00?
41. The property taxes on a house were \$1050. What was the tax rate if the house was valued at \$70,000?
42. The discount on a computer was \$150. This was a 20% discount.
- What was the original selling price of the computer?
  - What was the sale price?
  - What was the total amount paid for the computer if a 6% sales tax was added to the sale price?
43. The discount on men's suits was \$50, and they were on sale for \$200.
- What was the original selling price?
  - What was the rate of discount?
  - What was the total amount paid for the suit if an 8% sales tax was added to the sale price?
44.  Taylor is enrolled in a calculus course. She has the choice of buying the text in hardback form for \$60.00 or in paperback form for \$46.50. Tax is figured at 5% of the selling price. The bookstore buys back hardback books for 40% of the selling price and paperback books for 30% of the selling price.
- Which book is the more economical buy for Taylor if she sells her book back to the bookstore at the end of the semester?
  - How much does she save?
45. A realtor works on 6% commission. What is his commission on a house he sold for \$195,000?
46. A realtor selling commercial property works on a 4% commission. What is her commission on a building she sold for \$875,000?
47. A car saleswoman earns a commission of 7% on each car she sells. How much did she earn on the sale of a car for \$12,500?
48. A realtor works on 6% commission. What is his commission on a house he sold for \$125,000?
49. If a salesman works on a 10% commission (no monthly salary), how much merchandise will he have to sell to earn \$2800 in one month?







50. A realtor works on a 5% commission. How much would she need to sell a house for in order to earn \$24,250 in commission?
51. A sales clerk receives a monthly salary of \$500 plus a commission of 6% on all sales over \$3500. What did the clerk earn the month she sold \$8000 in merchandise?
52. A sales clerk receives a monthly salary of \$1295 plus a commission of 7% on all sales over \$2500. What did the clerk earn the month she sold \$16,000 in merchandise?
53. A shoe saleswoman works on a fixed salary of \$1440 per month plus an 8% commission. How much did she make during the month in which she sold \$13,500 worth of shoes and accessories?
54.  Suppose you sell your home for \$180,000 and you owe the bank \$60,000 on the mortgage. You pay a real estate agent a commission of 6% of the selling price, and other fees and taxes totaling \$1200. How much money do you make from the sale?
55.  Suppose you sell your three-bedroom home for \$180,000 and you owe the balance of the mortgage of \$55,000 to the bank. You pay a real estate agent a fee of 6% of the selling price and other fees and taxes that total \$1500. How much money do you make from the sale?
56.  Scott is buying a beach house off the coast of South Carolina for \$260,000. The bank will loan him \$225,000. If he must also pay a 4% commission to the real estate agent and \$3800 in taxes and other fees, how much cash does he need?
57.  A computer programmer was told that he would be given a bonus of 5% of any money his programs could save the company. How much would he have to save the company to earn a bonus of \$500?
58. Central Valley Community College had 48 teams compete at their 3rd annual corn hole tournament. The following year they had 54 teams compete. What was the percent increase in competing teams?
59. Due to the increasing cost of breakfast cereals, more and more people are buying private-label brands rather than national brands. In a recent year, the sale of private-label cereals rose from 170 million boxes to 180 million boxes. What was the percent increase in sales (to the nearest tenth of a percent)?
60.  The decade from 1960 to 1970 saw the largest 10-year increase in the number of male elementary and high school teachers in our nation's history. There was an increase from 402,000 to 691,000. What was the percent increase from 1960 to 1970 (to the nearest one percent)?
61.  The average attendance to a Yankees game in 2009 was 45,364 fans. In 2010 the average attendance grew to 46,491 fans. Find the percent increase in attendance. Round your answer to the nearest thousandth.
62.  In 1966, the student enrollment at California Polytechnic State University in San Luis Obispo, CA, was 7740. In 1977, the university had 15,502 students. Since that time the enrollment growth has slowed. What was the percent increase of student enrollment during that eleven year period? Round your answer to the nearest tenth of a percent.<sup>1</sup>



### The 28/36 Rule

Nobody wants to lend money to someone who cannot pay it back. Banks use multiple measures to decide whether a borrower would qualify for a mortgage. The most important factor is how much you earn; the more money you make, the more banks are willing to lend to you. According to Investopedia, a general rule of thumb is that banks want their borrowers to spend no more than 28% of gross income on housing expenses (mortgage, insurance, condo fees) and no more than 36% on all debts (mortgage, car loans, student loans).

<sup>1</sup> Source: [lib.calpoly.edu/universityarchives/history/timeline](http://lib.calpoly.edu/universityarchives/history/timeline)

63.  Frisco, Texas, had the largest population growth among large cities in 2022. In 2021, the population of Frisco was 208,262. The percent increase between 2021 and 2022 was 3.2%. What was the population of Frisco in 2022 (to the nearest whole number)?
64.  The population of the world was 7.9 billion in 2022 with an expected percent increase of 1% per year. At this rate of increase, what was the expected population of the world for the year 2024? Round your answer to the nearest tenth of a billion. (**Hint:** First find the expected population for 2023. Then use this answer to find the expected population for 2024.)<sup>2</sup>
65.  In April 2022, Best Buy sold a 12.9" iPad Pro for the reduced price of \$1599.99. The original price was \$1799.99.
- How much was the price reduced in terms of dollars?
  - Find the percent decrease or reduction. Round your answer to the nearest hundredth of a percent.
66.  The 2010 population of Wheeling, WV, was 43,002 while the 2015 population dropped to 42,573. What was the percent decrease of population in that five year period? Round your answer to the nearest tenth of a percent.<sup>3</sup>
67.  The circulation of the Washington Post newspaper was approximately 633,100 in 2009, and it dropped to 395,234 in 2015. What was the percent decrease in circulation? Round your answer to the nearest percent.<sup>4</sup>
68.  The Dow Jones Industrial Index had a peak of 13,930 in October of 2007, but dropped to a minimum of 7,063 in February 2009. Fortunately this dip was short lived, and the market started increasing again. What was the percent decrease in the stock market drop according to the Dow Jones Industrial Index during this sixteen month interval? Round your answer to the nearest tenth of a percent.<sup>5</sup>
69. A company manufactures and sells plastic boxes that cost \$21 each to produce, and that sell for \$28 each.
- How much profit does the company make on each box?
  - What is the percent of profit based on cost?
  - What is the percent of profit based on selling price?
70. Men's suits were on sale for \$300. Each one cost the store owner \$250.
- What was the profit for the store?
  - What as the store's percent profit based on cost?
  - What was the store's percent profit based on selling price?
71. The cost of a 65" smart TV to a store owner was \$450, and she sold the TV for \$630.
- What was her profit?
  - What was her percent of profit based on cost?
  - What as her percent of profit based on selling price?

2 Source: Worldometer, [www.worldometers.info/world-population](http://www.worldometers.info/world-population)

3 Source: [www.city-data.com/zips/26003.html](http://www.city-data.com/zips/26003.html)

4 Source: <https://capitolcommunicator.com/washington-post-circulation-drops-37-percent-since-2009-states-dcrtv/>

5 Source: <https://stockcharts.com/freecharts/historical/marketindexes.html>

72. A set of golf clubs cost a golf pro \$400, and she sold them in the pro shop for \$550.
- What was her profit?
  - What was her percent of profit based on cost?
  - What was her percent of profit based on selling price?
73. An art gallery sells paintings by a local artist for \$2500 each. The gallery owner has agreed to pay the artist \$2000 for each painting of a certain size.
- What is the profit on each painting?
  - What is the percent of profit based on cost?
  - What is the percent of profit based on selling price?
74. The cost of an 85" smart TV to a store owner was \$3300 and he sold the TV for \$4500.
- What was his profit?
  - What was his percent of profit based on cost?
  - What was his percent of profit based on selling price?
75. The Golf Pro Shop had a set of 10 golf clubs that were marked on sale for \$860. This was a discount of 20% off the original selling price.
- What was the original selling price?
  - If the clubs cost the Golf Pro Shop \$602, what was its profit?
  - What was the shop's percent of profit based on the original selling price?
  - What was the percent of profit based on the sale price?
76. A car dealer bought a 10-year-old car for \$2500. He marked up the price so that he would make a profit of 25% based on his cost.
- What was the selling price?
  - If the customer paid 8% of the selling price in taxes and fees, what was the customer's total cost for the car?

Another common use of percent is to calculate the tip on a bill. Tips are most commonly left in restaurants, but also apply to any service-based industry. Solve each problem, using the guidelines outlined in the problem to find the tip.

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77. You invited your friend to lunch at the local coffeehouse, and the bill totaled \$12.60. Your friend offered to leave the tip. What amount did he leave if he tipped 15% on the total bill?
78. Mrs. Chung had two large pizzas delivered to her home for \$26.00. If she tipped the delivery person 18%, what total amount did she pay the driver?
79. On a recent business trip, Ken and Joe had breakfast at the restaurant next to the motel where they were staying. Ken's breakfast bill was \$6.95 and Joe's was \$8.75. How much should each man have left as a tip if each tipped 20%?
80. The bill for a family dining at a restaurant was \$38.40. What would a 15% tip be? What total amount should they leave on the table if they want to go before the waiter comes to pick up the money?

81. Juan took his date out for dinner before the senior prom. The total bill, including tax, was \$48.00. How much did he tip the waitress if he left 18% (after tax)? What were his total expenses for the meal?
82. Walt decided to treat himself to lunch, and the bill was \$11.75, including tax. What amount did he leave as a 15% tip (after tax)? What was the total amount he paid for lunch?
83. A lawyer took four clients to dinner. The total bill for dinner and drinks was \$150.00 plus a 6% sales tax. What amount did she leave as a tip if she calculated the tip after tax at 20%?
84. A math teacher took two of her colleagues to dinner, and the bill was \$65.00 plus a 6% sales tax.
- What amount did she leave as a 20% tip (before tax)?
  - What was the total amount, including tip, she paid for the dinner?
85. Ann paid for lunch at the local pizza parlor for three of her study partners because they were celebrating having passed a statistics exam. The bill was \$18.00 plus tax at 5%.
- What amount did she leave as a 20% tip (before tax)?
  - What was the total amount of her bill, including tip and taxes?
86. On Monday night, Alondra and Parker decided to stay home, watch a football game, and have Chinese food delivered. If the bill was \$23.00 plus tax at 7.5% and they tipped the driver 15% of the bill (before tax), what total amount did they pay?
87. The coach invited the basketball team to his home after the last game of the season and had six large pizzas delivered. If the bill was \$90.00 plus tax at 6% and he gave the driver an 18% tip (before tax), what total amount did he pay?

## Writing & Thinking

88. List the four basic steps for solving word problems. Of the four basic steps for solving word problems, which step do you think is the most important and why?
89. Determine how to calculate sales tax when eating out and relate this process to either a proportion and/or using the amount/base/rate equation. Give an example.
90. A man weighed 200 pounds. He lost 20 pounds in 3 months. Then he gained back 20 pounds 2 months later.
- What percent of his weight did he lose in the first 3 months?
  - What percent of his weight did he gain back?
  - The loss and gain are the same, but the two percentages are different. Explain why.
91. Explain the process to determine how to find percent of profit based on
- cost.
  - selling price.

## Collaborative Learning

With the class separated into teams of two to four students, each team is to analyze the following problem and decide how to answer the related questions. Then each team leader is to present the team's answers and related ideas to the class for general discussion.

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- 92.** Jerry works in a bookstore and gets a salary of \$500 per month plus a commission of 3% on whatever he sells. Wilma works in the same store, but she decided to work on a straight 8% commission.
- At what amount of sales will Jerry and Wilma make the same amount of money?
  - Up to that point, who will be making more?
  - After that point, who would be making more? Explain briefly. (If you were offered a job at this bookstore, which method of payment would you choose?)