Margin Exercise Answers

1. 2 hours **2.** First part took $\frac{4}{3}$ or $1\frac{1}{3}$ hours; Second part took $\frac{8}{3}$ or $2\frac{2}{3}$ hours. **3.** \$2300 in the low-risk stock; \$12,700 in the high-risk stock. **4.** 53 **5.** 38,000 students **6.** \$2300

9.6 Exercises

Concept Check

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

1. To calculate distance, find the product of the _____ and _____.
2. In the formula $Pr = I$, I represents _____, P represents_____, and r represents _____.
3. In a simple interest problem, if r is 0.12, this represents an interest rate of _____.
4. Given cost x, a discount of ____% can be represented as $0.25x$.
5. In the formula, $Pr = I$, the time period is ____ year(s).
6. When solving distance-rate-time problems, a/an _____ or _____ showing the known and unknown values is helpful.

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.)

7. When using the formula $I = Pr$, the value of r should be written as a percent.
8. In the distance-rate-time formula $d = r \cdot t$, the value t stands for the time spent traveling.
9. Profit can be determined by subtracting the cost from the selling price.
10. The concept of average can be used to find unknown numbers.

Applications

Solve.

1. Dana finds the perfect dress for the Freshman Dance on sale at Belk. If she paid \$95.96 for the dress on sale (before tax) and the dress was marked 20% off, find the original price of the dress.
   a. Is the 20% marked off the price she paid, or the original price?
   b. How do you represent the original price; the amount of the discount?
   c. Set up an equation and solve for the original price of the dress.

2. Tommy inherits $5000 from his grandmother. He decides to invest some of the money in a CD paying a 4% return and the rest in a money market account (MMA) paying a 3% return. How much did he invest in each if the total amount of return was $187.50?

a. How do you represent the money invested in the CD? The money invested in the MMA?

b. How do you represent the total amount of return from the CD; from the MMA?

c. Set up an equation by equating the values of the total amount of the return.

d. Solve the equation and answer the question.

3. Mary Kate is preparing the Chemistry lab for an experiment that calls for a solution containing 20% ethyl alcohol. However, she only has 10% solution and 25% solution.

a. How much alcohol is there in 20 liters of 10% alcohol solution?

b. Write an algebraic expression for the amount of alcohol contained in x liters of the 25% solution.

c. Write an algebraic expression for the total amount of solution created when x liters of the 25% solution is added to 20 liters of the 10% solution.

d. Take 20% of the amount in part c. and set it equal to the total from parts a. and b. to equate the amount of alcohol in the mixed solution to a 20% solution.

e. Solve the equation found in part d. to determine how much 25% solution Mary Kate used to make a 20% solution.

4. The local grocery store offers two varieties of salami at the deli counter. The price per pound of the second, more expensive, salami is $3 more than twice the price per pound of the first variety. If Johannes buys 2 pounds of each type of salami, and his total price is $29.94, find the price per pound for each variety of salami.

a. How do you represent the price of the first variety of salami; the second variety?

b. How do you represent the amount spent on the first variety; the second variety?

c. Set up an equation and find the price per pound of the first variety.

d. What is the price per pound of the second variety? Verify the two prices are correct.

5. Brian has a collection of dimes and quarters in his pocket. He has twice as many dimes as quarters, and the total value of the coins is $2.70. How many of each type of coin does he have?

a. Solve this problem by defining a variable, writing an equation, and solving that equation.

b. Explain how you can check your answer without using your equation from part a.

6. Two bicyclists, Chantelle and Taylor, start from opposite ends of a 19-mile-long bike path. Taylor rides her bike 6 mph faster than Chantelle, and the cyclists meet in 30 minutes. How fast was each of them riding? Draw a picture to represent the described problem.

a. Use a table to organize the information given in the problem.

b. Write an equation based on your diagram and/or table.

c. Solve the equation and relate your answer to the original problem.

7. What is Nathan's average rate of speed if he hikes 12.6 miles in 7.5 hours?

8. What is Amy's average rate of speed if she bikes 39.6 miles in 2.2 hours?

9. Jamie plans to take the scenic route from Los Angeles to San Francisco. Her GPS tells her it is a 420-mile trip. If she figures her average speed will be 48 mph, how long will the trip take her?

10. Scott's average speed on his drive from Memphis, TN, is 60 mph. If the total trip is 285 miles, how long should he expect the drive to take?

11. Jane rides her bike to Lake Junaluska. Going to the lake, her average speed is 12 mph. On the return trip, her average speed is 10 mph. If the round trip takes a total of 5.5 hours, how long does the return trip take?

12. Two planes which are 2475 miles apart fly toward each other. Their speeds differ by 75 mph. If they pass each other in 3 hours, what is the speed of each?

13. Marcus drives from Chicago to Detroit in 6 hours. On the return trip, his speed is increased by 10 mph and the trip takes 5 hours. Find his rate on the return trip. How far apart are the towns?

14. Tim and Barb have 8 hours to spend on a mountain hike. They can walk up the trail at an average rate of 2 mph and can walk down at an average rate of 3 mph. How long should they plan to hike uphill before turning around?

15. The Reeds are moving across Texas. Mr. Reed leaves $3\frac{1}{2}$ hours before Mrs. Reed. If his average speed is 40 mph and her average speed is 60 mph, how long will Mrs. Reed have to drive before she overtakes Mr. Reed?

16. After traveling for 40 minutes, Mr. Koole had to slow to $\frac{2}{3}$ his original speed for the rest of the trip due to heavy traffic. The total trip of 84 miles took 2 hours. Find his original speed.

17. A train leaves Cincinnati at 2:00 p.m. A second train leaves the same station in the same direction at 4:00 p.m. The second train travels 24 mph faster than the first. If the second train overtakes the first at 7:00 p.m., what is the speed of each of the two trains?

18. Maria runs through the countryside at a rate of 10 mph. She returns along the same route at 6 mph. If the total trip took 1 hour 36 minutes, how far did she run in total?

19. The distance from Atlanta, Georgia, to Washington, DC, is 620 miles. Driving in the middle of the night, it takes about 9 hours to get to Washington. Due to higher traffic volume, it takes 2 more hours to travel there during the day. What is the average rate of the driver during the day and during the night? (Round to the nearest whole number.)

20. Mr. Kent drove to a conference. The first half of the trip took 3 hours due to traffic. Traffic let up for the second half of the trip, and he was able to increase his speed by 20 mph to make sure he got there on time. Find his rates of speed if he traveled 2 hours at the second rate.

21. Jayden walked to his friend's house at a rate of 4 mph to borrow his friend's bicycle. Coming back home, he rode the bicycle at an average rate of 12 mph. The total time for the round trip was 1 hour 30 minutes. How far away does Jayden's friend live?

22. Once a week, Felicia walks/runs for a total of 6 miles. Felicia spends twice as much time walking as she does running. If she walks at a rate of 4 mph and runs three times faster than she walks, what is the time for each part?

23. Achilles is racing a tortoise and gives him a 2-hour head start. The tortoise runs at a pace of 10 miles per hour and Achilles runs at a pace of 25 miles per hour. How long will it take Achilles to catch up to the tortoise?

a. Fill out the $d = r \cdot t$ table. Let the variable t represent the amount of time that the tortoise has traveled.

	Rate (mph)	·	Time (min)	=	Distance (miles)
Tortoise					
Achilles					

b. When Achilles catches up to the tortoise, they will have traveled the same distance. Set up a linear equation using the information in the table.

c. Solve the equation from part b. for the variable.

d. How long will it take Achilles to catch up to the tortoise?

e. If the race is 35 miles long, will Achilles pass the tortoise before crossing the finish line? Show work to support your answer.

24. Amanda invests $25,000, part at 5% and the rest at 6%. The annual return on the 5% investment exceeds the annual return on the 6% investment by $40. How much did she invest at each rate?

25. Mr. Hill invests $10,000, part at 5.5% and part at 6%. The annual interest from the 5.5% investment exceeds the annual interest from the 6% investment by $251. How much did he invest at each rate?

26. The annual interest earned on a $6000 investment was $120 less than the interest earned on $10,000 invested at 1% less interest per year. What was the rate of interest on each amount?

27. Two investments totaling $16,000 produce an annual income of $1140. One investment yields 6% a year, while the other yields 8% per year. How much is invested at each rate?

28. The annual interest on a $4000 investment exceeds the interest earned on a $3000 investment by $80. The $4000 is invested at a 0.5% higher rate of interest than the $3000. What is the interest rate of each investment?

29. D'Andra makes two investments that total $12,000. One investment yields 8% per year and the other 10% per year. The total interest for one year is $1090. Find the amount invested at each rate.

30. A company is planning to invest $42,000 into two simple interest accounts. The annual interest rate on one of the accounts is 4.5% while the rate on the other is 6%. How much should the company invest in each account so that the two accounts will produce an equal annual interest income?

31. Savannah invests $3600 per year into her retirement account, a portion of which is a contribution match from her employer. Savannah invests the employer match in a high-risk fund that averages a return of 8% and invests the rest in a low-risk account that averages a return of 4%. She wants to earn a total of $198 in interest for the year. How much should be invested in each fund?

a. Fill out the $I = P \cdot r$ table. Let the variable P represent the amount of money invested in the high-risk fund.

	Principal ($)	·	Rate	=	Interest ($)
High-Risk Fund					
Low-Risk Fund					

b. Write an equation to represent the total interest earned for the year by using the information in the table.

c. Solve the equation from part b. for the variable.

d. How much should be invested in each fund?

e. Verify that investing the amounts from part d. at the given rates yields $198 total interest in Savannah's retirement account.

32. A particular style of shoe costs a shoe store $81 per pair. What should the selling price of the shoes be so a 10% discount results in a 25% profit?

33. Sebastian would like both of his investments, a total of $12,000, to bring him the same annual interest income. One of his investments is at 5.5% annual interest rate and the other at 7%. Find the amount of money that Sebastian should invest in each account.

34. A car dealer paid $3800 for a used car. For his upcoming Labor Day sale, he wants to offer a 10% discount off the posted selling price, but would still like to make a 35% profit. What price should he advertise for that car?

35. Gabriella got some money from her grandparents as a graduation present. She decided to invest all of it. Part of the money was invested at a 2.5% interest rate, and the rest at a 4% interest rate. She invested $200 more in the 4% account than the 2.5% account. If her annual interest income was $47, how much did she invest at each rate?

36. Jordan is earning 1.5% interest from money invested in a savings account and 4% interest on a mutual bond fund. If the total of his investments is $18,000 and the annual interest from the savings account is less than the annual interest from the bond by $60, how much has Jordan invested at each rate?

37. A small company invested $20,500 such that a part of the money is in an account with a 4% interest rate and the rest at a 5% rate. The annual interest from the 5% account is $35 more than the interest earned from the 4% account. Find the amount of money the company invested at each rate.

38. During the month of January, a department store would like to have a sale of 40% off of women's knee-high boots. The store purchased the boots for $33 per pair. How much should the selling price be, if the manager of the store wants to make a 10% profit per pair?

39. Carla plans on buying a new pair of sandals for the summer. They are on sale for 20% off of the original price. What was the original price of the sandals, if she pays $34.83, with 7.5% sales tax?

40. Last year, an individual invested some money at a 5% interest rate and $2200 less than that amount at a 6% interest rate. If his interest income was $880, how much did he invest at each rate?

41. A store purchased a certain style of leather jacket at $70 per jacket. If the store wants to sell the jackets at a 20% discount and still make a profit of 30%, what should be the marked selling price for each jacket?

42. After receiving a 10% off coupon in the mail, Mark decided that it was time to buy new headphones. Using the coupon and paying 8% sales tax, the final price came to $213.84. What was the listed price of the headphones?

43. Robin's Refurbished Wrecks purchased a used car for $2850. For the upcoming Labor Day sale, the car dealership would like to offer a 5% discount off the posted selling price of the car, but would still like to make a 40% profit. What price should the car dealership advertise for the car?

a. Use the purchase price of the car to determine how much a 40% profit will be.

b. Use the variable x to represent the actual selling price of the car. Write an expression to represent the selling price of the car after the 5% discount.

c. Write an equation the represents the situation by using the answers from parts a. and b. along with the equation *selling price − cost = profit*.

d. Solve the equation from part c.

e. What does the answer from part d. mean? Write a complete sentence.

44. Marissa has five exam scores of 75, 82, 90, 85, and 77 in her chemistry class. What score does she need on the final exam to have an average grade of 80 (and thus earn a grade of B)? (All exams have a maximum of 100 points.)

45. Gerald had scores of 80, 92, 89, and 95 on four exams in his algebra class. What score will he need on his fifth exam to have an overall average grade of 90? (All exams have a maximum of 100 points.)

46. While riding her bike to the park and back home five times, Stacey timed herself at 60 min, 62 min, 55 min (the wind was helping), 58 min, and 63 min. She had set a goal of having an average time of 60 minutes for her rides. How many minutes will she need on her sixth ride to attain her goal?

47. For every 4-week period, Lauren wants to make an average of 6 phone calls per week. The first week she made 9 phone calls; the second week she made 6 phone calls, and the third week 5 phone calls. How many phone calls does Lauren need to make in the fourth week to make sure she stays on track with her goal?

48. While growing up, Jason was allowed to watch TV an average of 3 hours a day over a one-week period. One particular week he watched 1 hour, 2 hours, 1 hour, 3 hours, 3 hours, and 5 hours. How many hours could Jason watch the seventh and last day of the week and still obey his parents?

49. A college student realized that he was spending too much money on video games. For the remaining 5 months of the year, his goal is to spend an average of $50 a month towards his hobby. How much can he spend in December, taking into consideration that the other 4 months he spent $70, $25, $105, $30, respectively?

50. Wade has scores of 59, 68, 76, 84, and 69 on the first five tests in his social studies class. He knows that the final exam counts as two tests. What score will he need on the final to have an average of 70? (All tests and exams have a maximum of 100 points.)

51. A statistics student has grades of 86, 91, 95, and 76 on four hour-long exams. What score must he receive on the final exam to have an average grade of 90 if

a. the final is equivalent to a single hour-long exam (100 points maximum)?

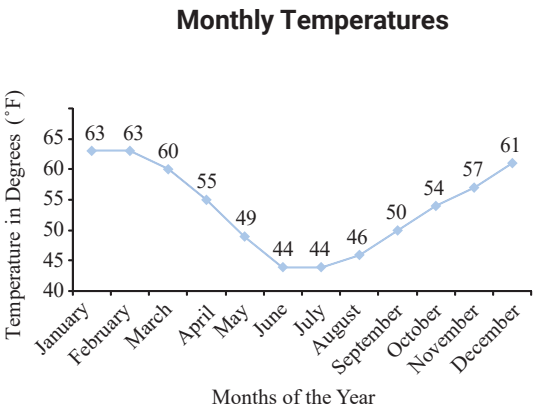
b. the final is equivalent to two hour-long exams (200 points maximum)?

52. Consider the monthly temperatures over a year for a city in New Zealand.

a. Find the average temperature for the year. (Round to the nearest tenth.)

b. Find the minimum average monthly temperature for the year.

c. Find the difference in average monthly temperature between the months of June and December.



TV Watching Trend

In recent years, there has been a decline in the watching of network television. With the expansion of alternative programing options such as Netflix and Amazon Prime Video, more people are switching away from the traditional networks. This can also be seen in the nominations (and winners) of the television awards. Lately, the list of award nominees barely includes any of the traditional networks' shows or actors. The graph shows the decline in television viewing among millennials from 2014 through 2018.

Source: www.usatoday.com/story/life/tv/2018/11/12/cord-cutting-and-streaming-younger-viewers-cut-into-traditional-tv-viewing/1924404002

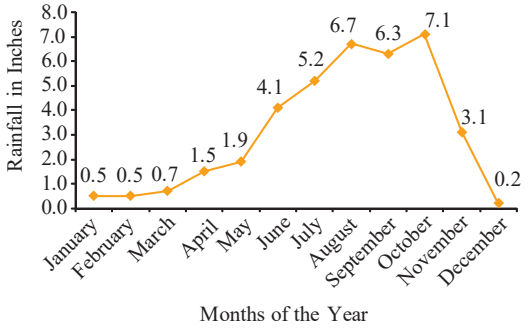
53. Consider the averages of monthly rainfall over a year for Visakhapatnam, India. [1]

a. Find the average rainfall for the year. (Round to the nearest tenth.)

b. Find the maximum average monthly rainfall for the year.

c. Find the difference in average monthly rainfall between the months of October and December.

Average Monthly Rainfall in Visakhapatnam, India



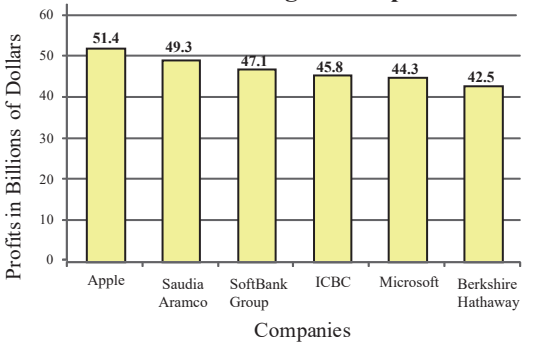
54. Consider the yearly profits of the world's largest companies in 2020. [2]

a. Find the average profits of the companies in the year 2020. (Round to the nearest tenth of a billion.)

b. Find the yearly profits of SoftBank Group in the year 2020.

c. What was the difference in profits between ICBC and Berkshire Hathaway?

Profits of World's Largest Companies in 2020



1 Source: www.weather.com

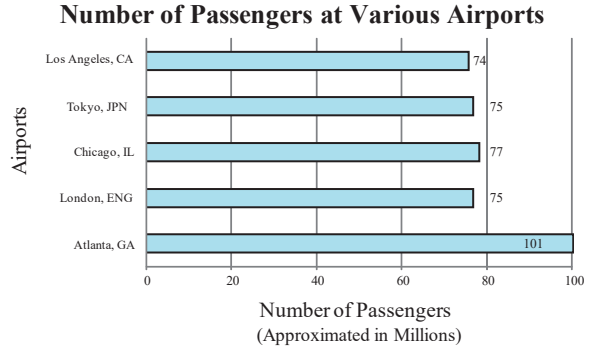
2 Source: "Leading companies in the world in 2020, by net income," Statistica, August 2021, www.statista.com/statistics/269857/most-profitable-companies-worldwide/.

55. Consider the number of passengers at the following airports. [3]

a. Find the average number of passengers.

b. Find the difference in passengers between Atlanta, GA, and Tokyo.

c. What was the total number of passengers to go through London?



56. Kevin consulted a dietician who told him to consume an average of 2100 calories per day based on his age, current weight, activity level, and weight goals. Kevin kept track of his calorie intake for several days. He consumed 2050 calories on Monday, 2200 calories on Tuesday, 2300 calories on Wednesday, and 2400 calories on Thursday. How many calories would he need to consume on Friday to have an average calorie intake of 2100 for the five days?

a. Set up an equation to solve for the amount of calories Kevin would need to consume on Friday. Use the variable x to represent the number of calories needed.

b. Solve the equation from part a. for the variable.

c. Some sources recommend that active men consume more than 1500 calories per day to avoid triggering "starvation mode" in the body. Can Kevin stay above this calorie amount and meet his recommended average for the 5 days?

d. Do you think this is a smart way for Kevin to adjust his average calorie intake? If not, what are some alternatives?

Writing & Thinking

Each of the following problems is given with an incorrect answer. Explain how you can tell that the answer is incorrect without needing to solve the problem or do any algebra; then, solve the problem correctly.

57. The perimeter of an isosceles triangle is 16 cm. Since the triangle is isosceles, two sides have the same length; the third side is 2 cm shorter than one of the two equal sides. Find the length of one of the two equal sides. **Incorrect answer: 9 cm**

58. Leela found a used textbook, which was marked down 50% from the price of the new textbook. If the used textbook cost $60, how much did the new textbook cost? **Incorrect answer: $90**

59. Kareem can paddle his kayak at 6 mph in still water. He decides to go kayaking on the local river. He paddles downriver (with the current) for 2 hours; then he turns around and paddles upriver (against the current) for 2.5 hours, returning to his starting point. How fast is the current in the river? **Incorrect answer: 27 mph**

3 Source: Airports Council International – North America