

Computational Exercises

In Exercises 9–16, state whether the equation is a linear equation in one variable or not.

9. $3x(2 - x) = x - 3$

10. $4x^2 = 5(x - 2)$

11. $7x = 3(x + 3)$

12. $9x - 7 + 2x = 3$

13. $\frac{5}{x} + x = 3x$

14. $\frac{2}{5}x - \frac{3}{x} = 4$

15. $7(x - 3) = 2x$

16. $\frac{1}{3}x = 7$

In Exercises 17–24, decide if the given value is a solution to the equation.

17. $x^2 = 1$; $x = -1$

18. $3x - 2 = 7$; $x = 3$

19. $4(x - 1) = 3x$; $x = -3$

20. $\frac{2}{3}x = 3(x - 2)$; $x = 3$

21. $3(x + 2)^2 = 12$; $x = 0$

22. $2(x + 3) - 4 = 3x + 3$; $x = -1$

23. $\frac{2x + 3}{2} - 6 = 11 - \frac{4}{x}$; $x = 8$

24. $\frac{24}{3y} + 5 = \frac{-3y + 7}{3} - 3$; $y = -3$

For Exercises 25–70, solve each equation.

25. $x + 6 = 32$

26. $7 + x = 43$

27. $36 = x - 9$

28. $-5 = y - 2$

29. $9x = 27$

30. $6x = 42$

31. $-3z = 36$

32. $-42 = -7z$

33. $6x + 12 = 48$

34. $10x - 30 = -5$

35. $-5x + 25 = -55$

36. $-3x + 18 = 42$

37. $2t + 10 = 4t - 30$

38. $5t - 6 = 2t - 24$

39. $-6x + 15 = 4x - 25$

40. $9 - 2x = 7 - x$

41. $3(x + 2) = 26$

42. $7(x - 3) = 42$

43. $6 + 3(x - 5) = 2(x - 3)$

44. $-2(4x - 7) = 3x - 8$

45. $12(x - 2) - 10(x + 7) = 14$

46. $-2x + 3 + 4(x - 6) = 18$

47. $6(3x - 11) - 4(3x - 1) = 8x - 12(4 - 5x)$

48. $21y - (2y - 3) = 7(9 - 5y) - 6(8 - 4y)$

49. $3t - 12(3 + t) - 4t = -(5 - t) - (7 - t)$

50. $2(3x + 4) - 5(6x - 7) = 8(9x - 10) - 11(12x + 13)$

51. $\frac{5}{6}x = 30$

52. $-\frac{1}{4}x = 2$

53. $\frac{3}{4}x + 2 = 21$

54. $\frac{1}{8}x - 10 = -16$

55. $\frac{5z}{6} + \frac{z}{3} = 30$

56. $\frac{3t}{4} + \frac{7t}{2} = 18$

57. $\frac{11}{12} - \frac{x}{4} = \frac{x}{3} + \frac{5}{6}$

58. $\frac{4x}{6} + \frac{x}{5} = \frac{2}{3} - \frac{x}{5}$

59. $\frac{7x}{3} + 5 = \frac{4x}{8} + 10$

60. $\frac{3x}{2} + \frac{1}{2} = \frac{4x}{5} + \frac{3}{5}$

61. $\frac{x}{6} + \frac{3x}{2} = \frac{4}{5} - \frac{2x}{15}$

62. $\frac{5}{12} - \frac{1}{3}x = \frac{2}{3}x - \frac{7}{6}$

63. $\frac{4x}{6} + \frac{2x}{7} = 3 + \frac{3x}{4}$

64. $\frac{4x - 1}{6} + 5 = \frac{x}{4}$

65. $\frac{x + 2}{2} + \frac{1}{4} = \frac{3x}{2} - 1$

66. $\frac{x + 3}{2} + \frac{3}{4} = \frac{3x}{2} - 1$

67. $\frac{3}{5} = \frac{2(x - 3)}{3} + \frac{x}{5}$

68. $\frac{x}{3} + \frac{5(x - 1)}{4} = \frac{3x}{4} - 1$

69. $\frac{x}{4} + \frac{3(x - 1)}{4} = \frac{2x}{3} - 6$

70. $\frac{y - 2}{3} + \frac{2y + 1}{6} = y - \frac{y + 4}{8}$

For Exercises 71–76, solve each equation for the specified variable.

71. $3x + 8 = 2y + 4$ for y

72. $5y = 3x + 2$ for x

73. $2 + 5x - 7y = 18$ for x

74. $5y - 3x + 2 = 10$ for y

75. $7x + 2y = 9$ for y

76. $3y + 6 = 2x + 8$ for x

For Exercises 77–84, indicate whether the equation is an identity or a contradiction and give the solution set.

77. $8x - 5 + 2x = 10x - 10 + 5$

78. $3x + 7 - x = 2x + 21$

79. $5(x - 3) + 2 = 5x - 8$

80. $4(x + 2) + 6 = 2x + 2x + 14$

81. $3x - 2 = 5(x - 3) - 2x$

82. $4x + 3(x - 2) = 7(x - 2) + 8$

83. $\frac{-2(y + 4)}{3} = \frac{-39}{9} - \frac{2y - 5}{3}$

84. $\frac{2}{3}x = \frac{4x - 2}{6}$

Applications in Our World

85. The electrical resistance for a conductor can be found by the formula $R = \frac{KL}{A}$. Solve the formula for L .
86. The illumination of a light can be found by the formula $I = \frac{C}{D^2}$. Solve the formula for C .
87. The volume of a cylinder can be found by the formula $V = \pi r^2 h$. Solve the formula for h .
88. The formula for the perimeter of a rectangle is $P = 2l + 2w$. Solve the formula for w .
89. The formula for the volume of a rectangular solid is $V = lwh$. Solve the formula for h .
90. The formula for converting mass to energy is $E = mc^2$. Solve the formula for m .
91. The formula for the distance traveled during an acceleration period is $d = \frac{1}{2}at^2$. Solve the formula for a .
92. The formula for earned run average in baseball is $E = \frac{R}{I} \times 9$. Solve the formula for I .
93. The formula for slugging percentage in baseball is $P = \frac{S + 2D + 3T + 4U}{A}$. Solve the formula for H .
94. The formula for the area of a triangle is $A = \frac{1}{2}bh$. Solve the formula for h .
95. The formula for the average a of two numbers b and c is $a = \frac{b+c}{2}$. Solve for b .
96. The centripetal force of an object can be found by using the formula $F = \frac{mv^2}{r}$. Solve the formula for r .

Exercises 97–100 use the following formula: the cost of a cell phone plan is given by the formula $C = 0.035m + 45$, where C is the cost per month, m is the number of minutes used per month, and \$45 is the basic monthly charge.

97. What is the cost if you use 300 minutes per month?
98. What is the cost if you use 1,000 minutes per month?
99. How many minutes would you get to talk per month if you want the total bill to be \$100?
100. How many minutes would you get to talk per month if you want the total bill to be \$150?

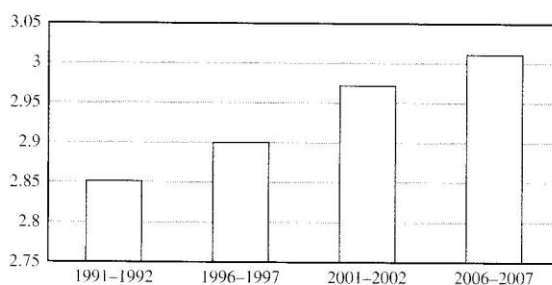
Exercises 101–104 use the following formula: the grade for Steve's English class can be calculated if he takes the sum of his three essay scores and divides that total by 3, as in the formula $G = (E1 + E2 + E3)/3$. Say he got an 80 on the first essay, $E1$, and he got a 95 on the second essay, $E2$.

101. What is his grade G if he gets a 70 on his third essay?
102. What is his grade G if he gets an 87 on his third essay?
103. What does he need to score on his third essay to get an overall grade of 80?
104. What does he need to score on his third essay to get an overall grade of 90?

Exercises 105–108 use the following formula: the power of a circuit can be computed by the formula $P = V^2/R$,

where P is the power in watts, V is the voltage, and R is the resistance in ohms.

105. For a 25-volt circuit, find the power for a resistance of 10 ohms.
106. For a 50-volt circuit, find the power for a resistance of 25 ohms.
107. For a 30-volt circuit, find the resistance in ohms for 100 watts of power.
108. For a 20-volt circuit, find the resistance in ohms for 250 watts of power.
109. The bar graph below shows the average grade point averages for all students at a group of 38 public colleges for 4 different school years. The equation $G = 2.84 + 0.01x$ can be used to approximate the average GPA, where x represents the number of years after 1990 that the school year began.
- How do values from the equation compare to actual values from the graph?
 - If the trend described by the given equation continues, in what year will the average GPA reach 3.3? What about 3.5?
 - Does this information mean that students are getting smarter? Discuss some possible interpretations.



Source: gradeinflation.com

110. The bar graph on the next page shows the average grade point averages for all students at a group of 19 private colleges for 4 different school years. The equation $G = 3.08 + 0.014x$ can be used to approximate the average GPA, where x represents the number of years after 1990 that the school year began.
- How do values from the equation compare to actual values from the graph?
 - If the trend described by the given equation continues, in what year will the average GPA reach 3.6? What about 3.8?
 - Does this information mean that professors' grading standards are getting easier? Discuss some possible interpretations.

Computational Exercises

For Exercises 5–24, write each phrase in symbols.

5. 3 less than a number
6. A number decreased by 17
7. A number increased by 9
8. 6 increased by a number
9. 11 decreased by a number
10. 8 more than a number
11. 6 subtracted from a number
12. 7 times a number
13. One-half a number added to that number
14. 5 more than 3 times a number
15. The quotient of 3 times a number and 6
16. 4 less than 6 times a number
17. The quotient of a number and 14
18. The product of 7 and a number, all subtracted from 10.
19. Triple the sum of a number and pi.
20. One-fourth the difference of 12 and a number.
21. Three times a number subtracted from the quotient of twice that number and the sum of that number and 8.
22. The sum of 146 and the product of a number raised to the third power and 18.
23. The square of the sum formed from adding five times a number to three times a different number.

24. The square root of the difference between half a number and two-thirds of a different number.

For Exercises 25–34, solve each.

25. Six times a certain number plus the number is equal to 56. Find the number.
26. The sum of a number and the number plus 2 is equal to 20. Find the number.
27. Twice a number is 32 less than 4 times the number. Find the number.
28. The larger of two numbers is 10 more than the smaller number. The sum of the numbers is 42. Find the numbers.
29. The difference of two numbers is 6. The sum of the numbers is 28. Find the numbers.
30. Five times a number is equal to the number increased by 12. Find the number.
31. Twice a number is 24 less than 4 times the number. Find the number.
32. The difference between one-half a number and the number is 8. Find the number.
33. Twelve more than a number is divided by 2. The result is 20. Find the number.
34. Eighteen less than a number is tripled, and the result is 10 more than the number. Find the number.

Applications in Our World

35. A math class containing 57 students was divided into two sections. One section has three more students than the other. How many students were in each section?
36. In 2011, the Coca-Cola company and PepsiCo had combined revenues of \$101.6 billion, with PepsiCo revenues \$31.4 billion higher. Find the revenue for each company.
37. The cost, including sales tax, of a Ford Focus SE is \$19,392.70. If the sales tax is 6%, find the cost of the car before the tax was added.
38. During the first day of a heat wave, an emergency room had three times as many patients as the day before. There were 48 patients seen total over the 2-day period. How many patients visited the E.R. on each day?
39. Three students that share a townhouse find that their electric bill for October is \$2.32 less than the September bill. The total of both bills is \$119.56, and each bill is split evenly among the roommates. How much did each owe in September?
40. If Marita invested half of her money at 8% and half at 6% and received \$210 simple interest, find the total amount of money invested.
41. A basketball team played 32 games and won 4 more games than it lost. Find the number of games the team won.
42. The enrollment of students in evening classes at a local university decreased by 6% between the years of 2012 and 2013. If the total number of students attending evening classes in both years was 16,983, find how many students enrolled in evening classes in each of those years.
43. If a television set is marked $\frac{1}{3}$ off and sells for \$180, what was the original price?
44. A carpenter wanted to cut a 6-foot board into three pieces so that each piece is 6 inches longer than the preceding one. Find the length of each piece.
45. The Halloween Association reported that last year, Americans spent \$0.68 billion more on candy than costumes for Halloween. If the total spent by Americans for both items was \$3.18 billion, how much did Americans spend on each item?
46. In a charity triathlon, Mark ran half the distance and swam a quarter of the distance. When he took a quick break to get a drink of Gatorade, he was just starting to bike the remaining 15 miles. What was the total distance of the race?
47. A nurse is told to give a patient recovering from surgery a total of 21 units of a potent antibiotic over 3 days. The dosage should be cut in half the second day, then in half again for the third day. How many units should she administer on the first day?

48. An investor flips a house, selling it for \$82,000. If her profit was 20%, how much did she pay for the house originally?
49. A father left $\frac{1}{2}$ of his estate to his son, $\frac{1}{3}$ of his estate to his granddaughter, and the remaining \$6,000 to charity. What was his total estate?
50. In 2011, there were 92 female officials in Congress, and there were 58 more female members of the House of Representatives than female senators. Find the number of females in each house of Congress.
51. While shopping on BlueFly.com, Juanita notices a special where if she buys two items, the third will be half off. She buys one item, then another item that is half of that amount, and then a third item that is a quarter of the original item amount. The discount she is given is half off the cheapest item. She ends up spending \$65 on the order (neglect taxes). What is the price of the first item she bought?
52. There were five winning lottery tickets for a total jackpot of \$24 million. Three of the winners won twice as much as the other two. How much did each of the two that won the least get?
53. In Mary's purse, there are \$3.15 worth of nickels and dimes. There are 5 times as many nickels as dimes. The vending machine is only taking dimes, and Mary needs 10 dimes for her purchase. Does Mary have enough dimes?
54. If the perimeter of a triangular flower bed is 15 feet with two sides the same length and the third side 3 feet longer, what are the measures of the three sides of the flower bed?
55. Last semester, Marcus's tuition bill was 12% cheaper than this semester's tuition bill of \$640. How much did Marcus pay for tuition last semester?
56. Jane and her two friends will rent an apartment for \$875 a month, but Jane will pay double what each friend does because she will have her own bedroom. How much will Jane pay a month?
57. In the 2012 Illinois Republican presidential primary, 839,238 votes were cast for the top three candidates. Mitt Romney got 107,704 more votes than Rick Santorum, who got 236,959 more votes than Ron Paul. What percentage of the ballots cast for the top three candidates did each receive?
58. Three sisters inherited \$100,000 from a rich uncle. The uncle's favorite niece got twice as much as his second favorite niece and the second favorite niece got twice as much as the least favorite niece. How much did the favorite niece get?
59. A bounty hunter makes a base monthly salary of \$1,700, plus \$900 for every bail-jumper he brings in. Write an algebraic expression that describes his monthly earnings, using a variable that stands for the number of fugitives he captures. Then use your equation to find how many fugitives he needs to average per month in order to make \$60,000 per year.
60. A telemarketer is paid \$3.70 per hour, plus \$0.30 for every caller she keeps on the line for at least a minute. Write an algebraic expression describing her hourly earnings, using a variable that stands for the number of callers she keeps on the line for at least a minute. Then use your equation to find how many callers she has to keep on the line for at least a minute over an 8-hour shift to make \$104.

Critical Thinking

61. The temperature and the wind combine to cause body surfaces to lose heat. Meteorologists call this effect "the windchill factor." For example, if the actual temperature outside is 10°F and the wind speed is 20 miles per hour, it will feel like it is -20°F outside, so -20°F is called the windchill. When it is 25°F outside and the wind speed is 40 miles per hour, it will feel like it is -35°F outside. From the information given, write a linear equation for determining the windchill using the actual temperature and the wind speed. Then use your equation to find the windchill factor on a day with temperature 30°F and 18 mile per hour winds.
62. Suppose your roommate brags that he made \$250 in singles and fives one night waiting tables, and that he collected four times as many one-dollar bills as five-dollar bills. How can you tell that he's not telling the exact truth?
63. The prevailing winds for air travel in the United States typically blow from west to east, slowing
- down travel to the west considerably. Last year, I flew from Cincinnati to Salt Lake City, a distance of 1,447 miles from east to west. The return flight took three-fourths as long as the flight out west. If the average speed of the plane in still air is 422 mph, what was the wind speed? (Assume it was the same for both flights.)
- (Hint: Use a variable to represent what you're asked to find, and fill in the following chart. The information will help you to write an equation.)

	Distance	Speed	Time
Cincinnati → Salt Lake			
Salt Lake → Cincinnati			

64. In an attempt to conserve energy (and, let's be honest, save some cash), Bob decides to ride his bike to work every day. He starts out by riding a half mile uphill, which slows him down by 4 miles per hour.