

3.4 EXERCISES

HOMEWORK KEY

○ = WORKED-OUT SOLUTIONS on p. WS5 for Exs. 11, 25, and 45

★ = STANDARDIZED TEST PRACTICE Exs. 2, 23, 24, 34, 45, and 47

SKILL PRACTICE

- VOCABULARY** Write a linear equation in three variables. What is the graph of such an equation?
- ★ WRITING** Explain how to use the substitution method to solve a system of three linear equations in three variables.

EXAMPLES 1, 2, and 3
on pp. 179–180
for Exs. 3–14

CHECKING SOLUTIONS Tell whether the given ordered triple is a solution of the system.

- | | | |
|--|--|--|
| 3. (1, 4, -3)
$2x - y + z = -5$
$5x + 2y - 2z = 19$
$x - 3y + z = -5$ | 4. (-1, -2, 5)
$4x - y + 3z = 13$
$x + y + z = 2$
$x + 3y - 2z = -17$ | 5. (6, 0, -3)
$x + 4y - 2z = 12$
$3x - y + 4z = 6$
$-x + 3y + z = -9$ |
| 6. (-5, 1, 0)
$3x + 4y - 2z = -11$
$2x + y - z = 11$
$x + 4y + 3z = -1$ | 7. (2, 8, 4)
$3x - y + 5z = 34$
$x + 3y - 6z = 2$
$-3x + y - 2z = -6$ | 8. (0, -4, 7)
$2x + 4y - z = -23$
$x - 5y - 3z = -1$
$-x + y + 4z = 24$ |

ELIMINATION METHOD Solve the system using the elimination method.

- | | | |
|--|--|--|
| 9. $3x + y + z = 14$
$-x + 2y - 3z = -9$
$5x - y + 5z = 30$ | 10. $2x - y + 2z = -7$
$-x + 2y - 4z = 5$
$x + 4y - 6z = -1$ | 11. $3x - y + 2z = 4$
$6x - 2y + 4z = -8$
$2x - y + 3z = 10$ |
| 12. $4x - y + 2z = -18$
$-x + 2y + z = 11$
$3x + 3y - 4z = 44$ | 13. $5x + y - z = 6$
$x + y + z = 2$
$3x + y = 4$ | 14. $2x + y - z = 9$
$-x + 6y + 2z = -17$
$5x + 7y + z = 4$ |

EXAMPLE 4
on p. 181
for Exs. 15–20

SUBSTITUTION METHOD Solve the system using the substitution method.

- | | | |
|---|--|--|
| 15. $x + y - z = 4$
$3x + 2y + 4z = 17$
$-x + 5y + z = 8$ | 16. $2x - y - z = 15$
$4x + 5y + 2z = 10$
$-x - 4y + 3z = -20$ | 17. $4x + y + 5z = -40$
$-3x + 2y + 4z = 10$
$x - y - 2z = -2$ |
| 18. $x + 3y - z = 12$
$2x + 4y - 2z = 6$
$-x - 2y + z = -6$ | 19. $2x - y + z = -2$
$6x + 3y - 4z = 8$
$-3x + 2y + 3z = -6$ | 20. $3x + 5y - z = 12$
$x + y + z = 0$
$-x + 2y + 2z = -27$ |

ERROR ANALYSIS Describe and correct the error in the first step of solving the system.

$$\begin{aligned} 2x + y - 2z &= 23 \\ 3x + 2y + z &= 11 \\ x - y + z &= -2 \end{aligned}$$

21.

$$\begin{array}{r} 2x + y - 2z = 23 \\ 6x + 2y + 2z = 22 \\ \hline 8x + 3y = 45 \end{array}$$



22.

$$\begin{aligned} z &= 11 + 3x + 2y \\ 2x + y - 2(11 + 3x + 2y) &= 23 \\ -4x - 3y &= 45 \end{aligned}$$



23. ★ **MULTIPLE CHOICE** Which ordered triple is a solution of the system?

$$2x + 5y + 3z = 10$$

$$3x - y + 4z = 8$$

$$5x - 2y + 7z = 12$$

- (A) (7, 1, -3) (B) (7, -1, -3) (C) (7, 1, 3) (D) (-7, 1, -3)

24. ★ **MULTIPLE CHOICE** Which ordered triple describes all of the solutions of the system?

$$2x - 2y - z = 6$$

$$-x + y + 3z = -3$$

$$3x - 3y + 2z = 9$$

- (A) $(-x, x + 2, 0)$ (B) $(x, x - 3, 0)$ (C) $(x + 2, x, 0)$ (D) $(0, y, y + 4)$

CHOOSING A METHOD Solve the system using any algebraic method.

25. $x + 5y - 2z = -1$
 $-x - 2y + z = 6$
 $-2x - 7y + 3z = 7$

26. $4x + 5y + 3z = 15$
 $x - 3y + 2z = -6$
 $-x + 2y - z = 3$

27. $6x + y - z = -2$
 $x + 6y + 3z = 23$
 $-x + y + 2z = 5$

28. $x + 2y = -1$
 $3x - y + 4z = 17$
 $-4x + 2y - 3z = -30$

29. $2x - y + 2z = -21$
 $x + 5y - z = 25$
 $-3x + 2y + 4z = 6$

30. $4x - 8y + 2z = 10$
 $-3x + y - 2z = 6$
 $2x - 4y + z = 8$

31. $-x + 5y - z = -16$
 $2x + 3y + 4z = 18$
 $x + y - z = -8$

32. $2x - y + 4z = 19$
 $-x + 3y - 2z = -7$
 $4x + 2y + 3z = 37$

33. $x + y + z = 3$
 $3x - 4y + 2z = -28$
 $-x + 5y + z = 23$

34. ★ **OPEN-ENDED MATH** Write a system of three linear equations in three variables that has the given number of solutions.

a. One solution

b. No solution

c. Infinitely many solutions

SYSTEMS WITH FRACTIONS Solve the system using any algebraic method.

35. $x + \frac{1}{2}y + \frac{1}{2}z = \frac{5}{2}$
 $\frac{3}{4}x + \frac{1}{4}y + \frac{3}{2}z = \frac{7}{4}$
 $\frac{1}{3}x + \frac{3}{2}y + \frac{2}{3}z = \frac{13}{6}$

36. $\frac{1}{3}x + \frac{5}{6}y + \frac{2}{3}z = \frac{4}{3}$
 $\frac{1}{6}x + \frac{2}{3}y + \frac{1}{4}z = \frac{5}{6}$
 $\frac{2}{3}x + \frac{1}{6}y + \frac{3}{2}z = \frac{4}{3}$

37. **REASONING** For what values of a , b , and c does the linear system shown have $(-1, 2, -3)$ as its only solution? *Explain* your reasoning.

$$x + 2y - 3z = a$$

$$-x - y + z = b$$

$$2x + 3y - 2z = c$$

CHALLENGE Solve the system of equations. *Describe* each step of your solution.

38. $w + x + y + z = 2$
 $2w - x + 2y - z = 1$
 $-w + 2x - y + 2z = -2$
 $3w + x + y - z = -5$

39. $2w + x - 3y + z = 4$
 $w - 3x + y + z = 32$
 $-w + 2x + 2y - z = -10$
 $w + x - y + 3z = 14$


40. $w + 2x + 5y = 11$
 $-2w + x + 4y + 2z = -7$
 $w + 2x - 2y + 5z = 3$
 $-3w + x = -1$

41. $2w + 7x - 3y = 41$
 $-w - 2x + y = -13$
 $-2w + 4x + z = 12$
 $-w - x + y = -8$


PROBLEM SOLVING

EXAMPLE 4
on p. 181
for Exs. 42–47

- 42. PIZZA SPECIALS** At a pizza shop, two small pizzas, a liter of soda, and a salad cost \$14; one small pizza, a liter of soda, and three salads cost \$15; and three small pizzas and a liter of soda cost \$16. What is the cost of one small pizza? of one liter of soda? of one salad?

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- 43. HEALTH CLUB** The juice bar at a health club receives a delivery of juice at the beginning of each month. Over a three month period, the health club received 1200 gallons of orange juice, 900 gallons of pineapple juice, and 1000 gallons of grapefruit juice. The table shows the composition of each juice delivery. How many gallons of juice did the health club receive in each delivery?

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Juice	1st delivery	2nd delivery	3rd delivery
Orange	70%	50%	30%
Pineapple	20%	30%	30%
Grapefruit	10%	20%	40%

- 44. MULTI-STEP PROBLEM** You make a tape of your friend's three favorite TV shows: a comedy, a drama, and a reality show. An episode of the comedy lasts 30 minutes, while an episode of the drama or the reality show lasts 60 minutes. The tape can hold 360 minutes of programming. You completely fill the tape with 7 episodes and include twice as many episodes of the drama as the comedy.

- a. Write a system of equations to represent this situation.
- b. Solve the system from part (a). How many episodes of each show are on the tape?
- c. How would your answer to part (b) change if you completely filled the tape with only 5 episodes but still included twice as many episodes of the drama as the comedy?

- 45. ★ SHORT RESPONSE** The following Internet announcement describes the results of a high school track meet.

High School Sports
Back Forward Stop Refresh Home Print Mail

http://aklrtonfagdt1nkn95kank5667jps8

Events > Track > Results

MADISON HIGH SCHOOL was the big winner in Saturday's track meet with the help of 20 individual-event placers earning a combined 68 points. A first-place finish earns 5 points, a second-place finish earns 3 points, and a third-place finish earns 1 point. Madison had a strong second-place showing, with as many second-place finishers as first- and third-place finishers combined.

- a. Write and solve a system of equations to find the number of athletes who finished in first place, in second place, and in third place.
- b. Suppose the announcement had claimed that the Madison athletes scored a total of 70 points instead of 68 points. Show that this claim must be false because the solution of the resulting linear system is not reasonable.

46. **FIELD TRIP** You and two friends buy snacks for a field trip. You spend a total of \$8, Jeff spends \$9, and Curtis spends \$9. The table shows the amounts of mixed nuts, granola, and dried fruit that each person purchased. What is the price per pound of each type of snack?

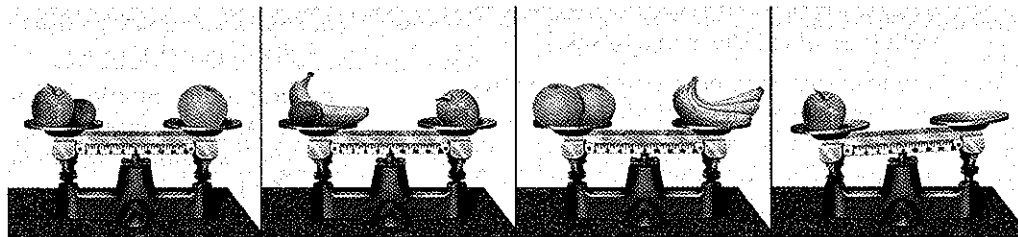
	Mixed nuts	Granola	Dried fruit
You	1 lb	0.5 lb	1 lb
Jeff	2 lb	0.5 lb	0.5 lb
Curtis	1 lb	2 lb	0.5 lb

47. **★ EXTENDED RESPONSE** A florist must make 5 identical bridesmaid bouquets for a wedding. She has a budget of \$160 and wants 12 flowers for each bouquet. Roses cost \$2.50 each, lilies cost \$4 each, and irises cost \$2 each. She wants twice as many roses as the other two types of flowers combined.

- Write** Write a system of equations to represent this situation.
- Solve** Solve the system of equations. How many of each type of flower should be in each bouquet?
- Analyze** Suppose there is no limitation on the total cost of the bouquets. Does the problem still have a unique solution? If so, state the unique solution. If not, give three possible solutions.



48. **CHALLENGE** Write a system of equations to represent the first three pictures below. Use the system to determine how many tangerines will balance the apple in the final picture. *Note:* The first picture shows that one tangerine and one apple balance one grapefruit.



MIXED REVIEW

PREVIEW

Prepare for
Lesson 3.5
in Exs. 49–52.

Perform the indicated operation. (p. 975)

49. $15 + (-8)$

50. $-4 - (-13)$

51. $15 \cdot 7$

52. $-4(-8)$

Find the slope of the line passing through the given points. Then tell whether the line rises, falls, is horizontal, or is vertical. (p. 82)

53. $(1, -4), (2, 6)$

54. $(4, 2), (-18, 1)$

55. $(6, -6), (-6, 6)$

56. $(-5, 2), (-5, 10)$

57. $(-2, 4), (-6, 8)$

58. $(-7, 3), (5, 3)$

Solve the system using any algebraic method. (p. 160)

59. $3x - y = -7$
 $2x + 3y = 21$

60. $3x + 2y = -3$
 $4x - 3y = -38$

61. $5x + y = 11$
 $2x + 3y = -19$

