Graphing the solution set on a number line yields the following. Note that the solution set to the inequality contains all values in the shaded regions.

b. Solving as two separate inequalities yields

$$\begin{array}{lll} 2x - 4 < 12 & or & x - 3 > -1 \\ \underline{+4 \quad +4} & or & \underline{+3 \quad +3} \\ 2x < 16 & or & x > 2 \\ x < 8 & or & x > 2 \end{array}$$

Graph the solution set on a number line yields the line below.

Notice that the two solution sets overlap each other. The union of the two sets, which includes all points in both sets, is the entire number line. Therefore, the solution set is the set of all real numbers.

PRACTICE PROBLEM FOR EXAMPLE 8

Solve each of the following compound inequalities. Graph the solution set on a number line.

a. $5x - 6 < 4$ *or* $2x \geq 14$ **b.** $x + 4 < 10$ *or* $x - 9 > -6$

2.4 Vocabulary Exercises

1. When solving a linear inequality, the inequality reverses when both sides are _____ or _____ by a negative number.
2. Mathematically, the word *and* indicates the _____ of two sets.
3. Mathematically, the word or indicates the _____ of two sets.
4. The compound inequality $a < x < b$ means x is _____ a and b.

2.4 Exercises

For Exercises 1 through 10, solve the given inequalities. Check the answer. Write the solution set as an inequality, using interval notation, and as a graph on a number line.

1. $5x + 7 > 37$
2. $4x - 10 < 2$
3. $\frac{P}{4} \geq 2$
4. $\frac{M}{6} < 4.5$
5. $8V + 4 < V - 20$
6. $3x + 7 \leq x - 5$
7. $2T + 12 < 5T + 39$
8. $4p - 8 > 15p - 41$
9. $\frac{K}{-4} + 7 \leq 21$
10. $\frac{V}{-5} - 4 \geq 3$

For Exercises 11 through 12, compare the two students' work to determine which student did the work correctly. Explain what mistake the other student made.

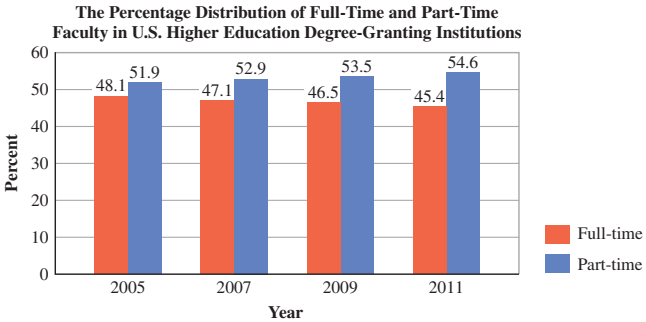
11. Solve $8 - 3x > 20$

Amy	*Michelle*
$8 - 3x > 20$	$8 - 3x > 20$
$\underline{-8 \quad -8}$	$\underline{-8 \quad -8}$
$-3x < 12$	$-3x > 12$
$\frac{-3x}{-3} > \frac{12}{-3}$	$\frac{-3x}{-3} < \frac{12}{-3}$
$x > -4$	$x < -4$

12. Solve $5x + 6 \leq 2x$

Mark	Marie
$5x + 6 \leq 2x$	$5x + 6 \leq 2x$
$-2x \quad -2x$	$-2x \quad -2x$
$3x + 6 \geq 0$	$3x + 6 \leq 0$
$-6 \quad -6$	$-6 \quad -6$
$\frac{3x}{3} \geq \frac{-6}{3}$	$\frac{3x}{3} \leq \frac{-6}{3}$
$x \geq -2$	$x \leq -2$

13. The percentage distribution of full-time and part-time faculty in U.S. higher education degree-granting institutions is given in the graph.



Source: National Center for Education Statistics.

a. Find equations for the models of these data.

b. Find when the percent of part-time faculty was less than or equal to the number of full-time faculty.

14. The populations of Afghanistan and Ghana are given in the table.

Years	Afghanistan Population (in millions)	Ghana Population (in millions)
2010	24.5	24.32
2011	25	24.93
2012	25.5	25.54
2013	26	26.16
2014	26.6	26.79
2015	27.1	27.41

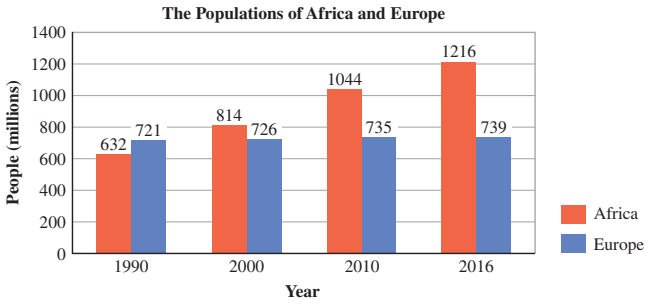
Source: www.tradingeconomics.com

a. Find equations for the models for the populations of Afghanistan and Ghana.

b. Determine the years for which Afghanistan will have more people than Algeria.

c. Is your prediction in part b reasonable?

15. The population on the continent of Africa has been growing rapidly over the past several decades. The populations of African and Europe are given in the chart below.



Source: https://en.wikipedia.org/wiki/List_of_continents_by_population

a. Find equations for the models for the populations of Africa and Europe.

b. Estimate when Africa had a greater population than Europe.

16. The amount of U.S. retail spending, in billions, on eating at home versus eating out is given in the table below.

Year	Amount Spent at Eating and Drinking Establishments (in billions)	Amount Spent in Grocery Stores (in billions)
2009	40.09	44.24
2010	41.88	45.28
2011	44.24	47.05
2012	47.15	48.43
2013	48.63	50.24
2014	52.98	52.47
2015	56.71	53.13

Source: US Census Bureau.

c. Find a model for the amount spent at eating and drinking establishments.

d. What does the slope for the model in part a mean in this context?

e. Find a model for the amount spent in grocery stores.

f. Estimate when the amount spent at eating and drinking establishments will be greater than the amount spent at grocery stores.

For Exercises 17 through 24, indicate what inequality symbol ($<, >, \leq, \geq$) would be used to represent the given phrase.

17. Cheaper than

18. Higher than

19. At least

20. Not more than

21. More expensive than

22. At most

23. Lower than

24. Not less than

25. The revenue and cost functions for a local cabinet manufacturer are

$$R(c) = 450c$$
$$C(c) = 280c + 20000$$

where $R(c)$ represents the monthly revenue in dollars from selling c cabinets and $C(c)$ represents the monthly cost in dollars to manufacture and sell c cabinets. Find the number of cabinets this company must sell each month to break even or make a profit.

26. Dan's Mobile Window Tinting tints car windows. Dan has determined his company's weekly revenue and cost functions as follows:

$$R(w) = 35w + 10$$
$$C(w) = 30w + 350$$

where $R(w)$ represents the weekly revenue in dollars from tinting w windows and $C(w)$ represents the weekly cost in dollars to tint w windows. Find the number of windows Dan must tint each week to break even or make a profit. At least 68 windows

27. Optimum Traveling Detail from Exercise 13 in Section 2.2 on page 151 has the revenue and cost functions:

$$R(a) = 175a$$
$$C(a) = 25a + 7800$$

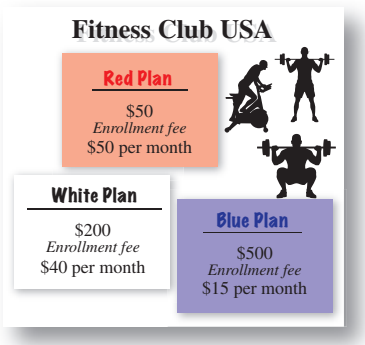
where $R(a)$ represents the monthly revenue in dollars for detailing a automobiles and $C(a)$ represents the monthly costs in dollars for detailing a automobiles. Find the number of automobiles Optimum Traveling Detail must detail to break even or make a profit.

28. A Table Affair from Exercise 14 in Section 2.2 on page 000 has the following weekly revenue and cost functions:

$$R(t) = 120t$$
$$C(t) = 45t + 800$$

where $R(t)$ represents the weekly revenue in dollars for selling t tablecloths and $C(t)$ represents the weekly costs in dollars for selling t table cloths. Find the number of tablecloths A Table Affair must sell to break even or make a profit.

29. Several plans for Fitness Club USA are advertised in the following flyer.



a. Write equations for the cost of these plans if a person keeps the plan for m months.

b. For what number of months will the Blue Plan be the cheapest plan?

30. Several equipment rental services have the following charges for a dump truck rental.

Company	Base Charges ($)	Hourly Rate ($)
Pauley's Equipment	100	65
You Haul It	80	70
Big Red's Equipment	80	75

a. Write equations for the cost of these three companies rentals if a person rents the dump truck for h hours.

b. For what number of hours will You Haul It be the cheapest?

31. The percent of transatlantic Internet traffic on the Internet backbone can be modeled by

$$B(t) = -8.51t + 164.14$$

where $B(t)$ represents the percent of transatlantic Internet traffic on the Internet backbone t years since 2000. The percentage of transatlantic Internet traffic on private networks can be modeled by

$$P(t) = 5.51t - 64.14$$

where $P(t)$ represents the percent of transatlantic Internet traffic on private networks t years since 2000.

Source: TeleGeography.

Determine when the percentage of transatlantic Internet traffic on private networks is greater than that on the Internet backbone.

32. The U.S. male labor force participation rate can be modeled by

$$M(t) = -0.15t + 89.78$$

where $M(t)$ represents the U.S. male labor force participation rate t years since 1900. The U.S. female labor force participation rate can be modeled by

$$F(t) = 0.30t + 29.48$$

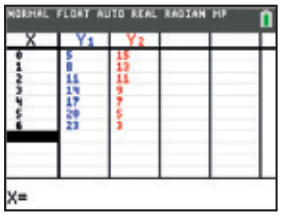
where $F(t)$ represents the U.S. female labor force participation rate t years since 1900.

Determine when the U.S. female labor force participation rate is less than the U.S. male labor force participation rate.

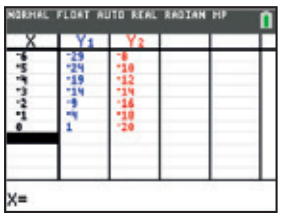
33. A salesperson earns a base salary of $1600 per month plus 12% commission on all sales. Find the minimum amount a salesperson would need to sell to earn at least $3800 for one month.

34. A salesperson earns a base salary of \$1725 per month plus 17% commission on all sales. Find the minimum amount a salesperson would need to sell to earn at least \$4200 for one month.

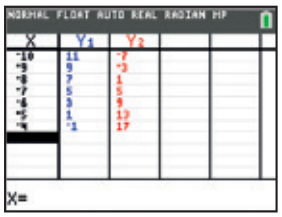
35. Use the table to find when $Y1 > Y2$.



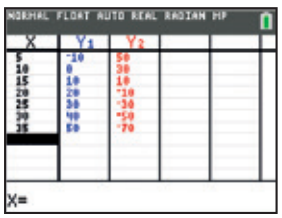
36. Use the table to find when $Y1 > Y2$.



37. Use the table to find when $Y1 > Y2$



38. Use the table to find when $Y1 > Y2$.



For Exercises 39 through 46, solve each inequality numerically, using your calculator table.

39. $8x + 1 > -2x + 51$

40. $4x - 8 < -x + 22$

41. $4.5x - 8 \leq 7.5x - 20$

42. $0.25x + 12 \geq 0.75x + 2$

43. $-1.5x + 18 \geq 2.5x + 4$

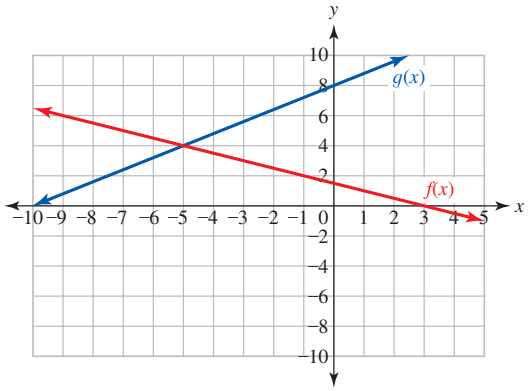
44. $-4.25x + 5.125 \leq 3.6x + 45.25$

45. $\frac{1}{4}x - 2 < -\frac{1}{2}x - 4.5$

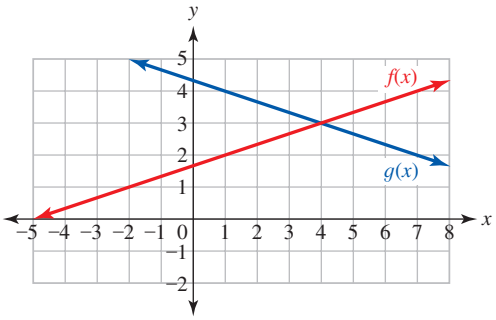
46. $\frac{2}{3}x + 4 > \frac{1}{3}x + 6$

For Exercises 47 through 50, use the graph to solve the given inequality.

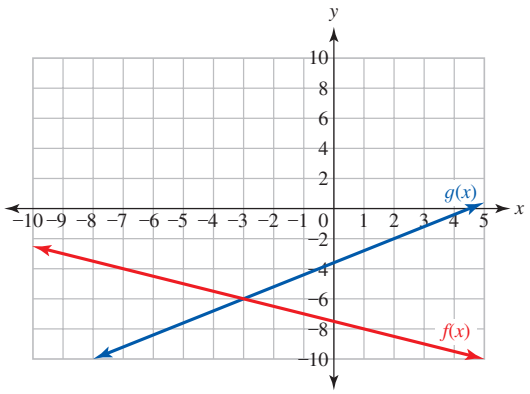
47. Use the graph to find when $f(x) < g(x)$.



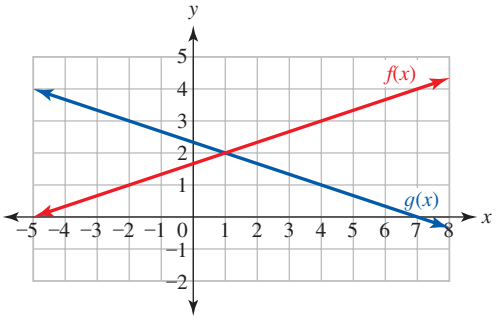
48. Use the graph to find when $f(x) < g(x)$



49. Use the graph to find when $f(x) \geq g(x)$.



50. Use the graph to find when $f(x) \geq g(x)$.



For Exercises 51 through 54, solve the inequality graphically.

51. $5x + 3 > -2x + 17$

52. $4.5x - 8 < 7.5x - 20$

53. $\frac{1}{2}x - 6 < -\frac{1}{3}x + 4$

54. $\frac{2}{5}x + 11 > \frac{4}{5}x + 3$

For Exercises 55 through 68, solve the inequality algebraically. Provide reasons for each step. Check the answer. Write the solution set as an inequality, using interval notation, and as a graph on a number line.

55. $5 + \frac{3x}{2} \leq -3$

56 $7 + \frac{4x}{3} \geq -15$

57 $5x + 3 \geq 3(x - 2)$

58 $4t - 3 > 2(t + 1)$

59 $\frac{-7d}{3} + 5 < 3$

60 $\frac{-2g}{9} + 12 > 4$

61 $2.7v + 3.69 > 1.5v - 6.5$

62 $3.4b + 2.45 < 0.3b - 8.5$

63 $3.2 + 2.7(1.5k - 3.1) \geq 9.43k - 17.5$

64 $8.7 - 1.4(8.2m + 6) \geq -2.3(7.1m - 4.3)$

65 $\frac{2}{5}(w - 20) \leq -\frac{3}{7}(2P - 12)$

66 $\frac{2}{3}(p + 4) < -\frac{5}{7}(2p - 12)$

67 $2.35 + 7.42 < 1.3x - 4.75$

68 $3.74x - 5.87 > 7.28x + 3.25$

Solve each compound inequality. Check the answer. Graph the solution set on a number line.

69. $7 < 5x - 3 < 12$

70. $-16 < 7x - 2 < 0$

71. $-4 \leq 2(t + 5) \leq 6$

72. $6 \leq 3(t + 8) \leq 12$

73. $-3 < 2n - 1$ and $2n - 1 < 8$

74. $8 < 4n + 3$ and $4n + 3 < 16$

75. $x + 2 < -4$ or $x + 2 > 4$

76. $x - 3 < -1$ or $x - 3 > 1$

77. $2x - 3 < -5$ or $2x - 3 > 5$

78. $4x + 1 < -2$ or $4x + 1 > 2$

79. $x - 2 < 7$ or $x - 2 > 5$

80. $x - 3 < 1$ or $x - 3 > -2$