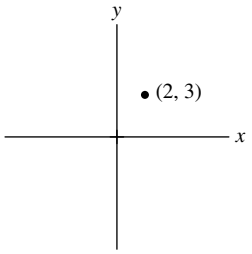
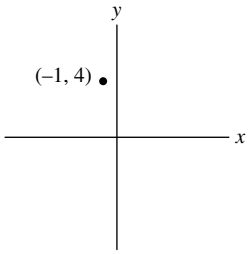
Chapter 1

Exercises 1.1

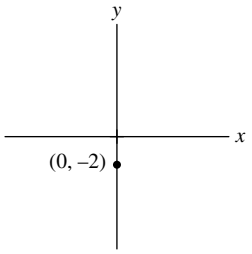
1. Right 2, up 3



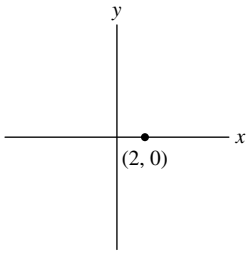
2. Left 1, up 4



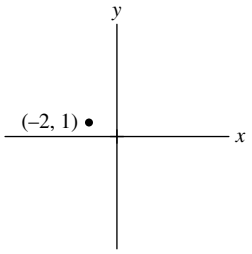
3. Down 2



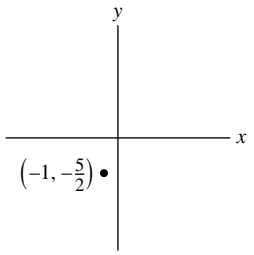
4. Right 2



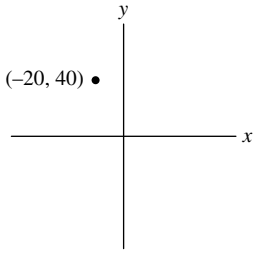
5. Left 2, up 1



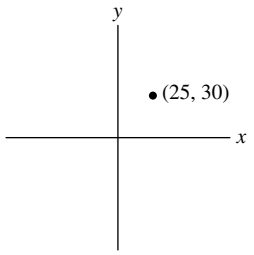
6. Left 1, down $\frac{5}{2}$



7. Left 20, up 40



8. Right 25, up 30



9. e

10. d

11. $-2(1)+\frac{1}{3}(3)=-2+1=-1$ so the point is on the line.

12. $-2(2)+\frac{1}{3}(6)=-1$ is false, so the point is not on the line

13. $-2x+\frac{1}{3}y=-1$ Substitute the x and y coordinates of the point into the equation: $\left(\frac{1}{2},3\right)\rightarrow -2\left(\frac{1}{2}\right)+\frac{1}{3}(3)=-1\rightarrow -1+1=-1$ is a false statement. So the point is not on the line.

14. $-2\left(\frac{1}{3}\right)+\left(\frac{1}{3}\right)(-1)=-1$ is true so the point is on the line.

15. $m = 5$, $b = 8$

16. m = –2 and b = –6

17. $y = 0x + 3$; $m = 0$, $b = 3$

18. $y=\frac{2}{3}x+0$; $m=\frac{2}{3}$, $b = 0$

19. $14x+7y=21$

$7y=-14x+21$

$y=-2x+3$

20. $x-y=3$

$-y=-x+3$

$y=x-3$

21. $3x=5$

$x=\frac{5}{3}$

22. $-\frac{1}{2}x+\frac{2}{3}y=10$

$\frac{2}{3}y=\frac{1}{2}x+10$

$y=\frac{3}{4}x+15$

23. $0=-4x+8$

$4x=8$

$x=2$

x-intercept: (2, 0)

y = –4(0) + 8

$y = 8$

y-intercept: (0, 8)

24. 0 = 5

no solution

x-intercept: none

When $x = 0$, $y = 5$

y-intercept: (0, 5)

25. When $y = 0$, $x = 7$

x-intercept: (7, 0)

0 = 7

no solution

y-intercept: none

26. $0 = –8x$

$x = 0$

x-intercept: (0, 0)

y = –8(0)

$y = 0$

y-intercept: (0, 0)

27. $0=\frac{1}{3}x-1$

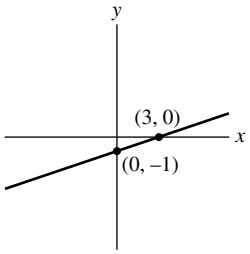
$x = 3$

x-intercept: (3, 0)

$y=\frac{1}{3}(0)-1$

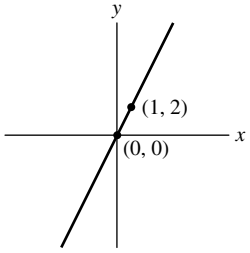
y = –1

y-intercept: (0, –1)



28. When $x = 0$, $y = 0$.

When $x = 1$, $y = 2$.



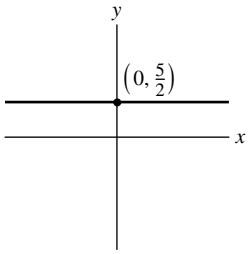
29. $0 = \frac{5}{2}$

no solution

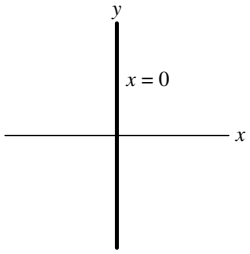
x-intercept: none

When $x = 0$, $y = \frac{5}{2}$

y-intercept: $\left(0, \frac{5}{2}\right)$



30. The line coincides with the y-axis.



31. $3x + 4(0) = 24$

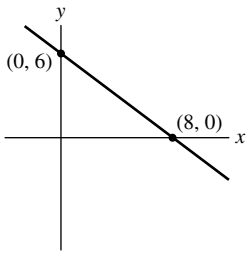
$x = 8$

x-intercept: (8, 0)

$3(0) + 4y = 24$

$y = 6$

y-intercept: (0, 6)



32. $x + 0 = 3$

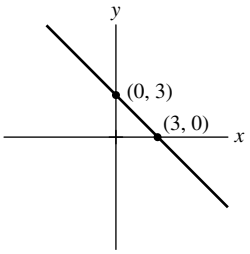
$x = 3$

x-intercept: (3, 0)

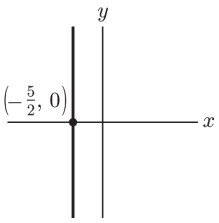
$0 + y = 3$

$y = 3$

y-intercept: (0, 3)



33. $x = -\frac{5}{2}$



34. $\frac{1}{2}x - \frac{1}{3}(0) = -1$

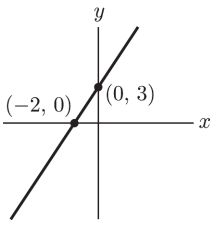
$x = -2$

x intercept (–2, 0)

$\frac{1}{2}(0) - \frac{1}{3}y = -1$

$y = 3$

y intercept (0, 3)



35. $2x+3y=6$

$3y=-2x+6$

$y=-\frac{2}{3}x+2$

a. $4x+6y=12$

$6y=-4x+12$

$y=-\frac{2}{3}x+2$

Yes

b. Yes

c. $x=3-\frac{3}{2}y$

$\frac{3}{2}y=-x+3$

$y=-\frac{2}{3}x+2$

$y=-\frac{2}{3}x+2$

Yes

d. $6-2x-y=0$

$y=6-2x=-2x+6$

No

e. $y=2-\frac{2}{3}x=-\frac{2}{3}x+2$

Yes

f. $x+y=1$

$y=-x+1$

No

36. $\frac{1}{2}x-5y=1$

$-5y=-\frac{1}{2}x+1$

$y=\frac{1}{10}x-\frac{1}{5}$

a. $2x-\frac{1}{5}y=1$

$-\frac{1}{5}y=-2x+1$

$y=10x-5$

No

b. $x=5y+2$

$5y=x-2$

$y=\frac{1}{5}x-\frac{2}{5}$

No

c. $2-5x+10y=0$

$-10y=-5x+2$

$y=\frac{1}{2}x-\frac{1}{5}$

No

d. $y=.1(x-2)$

$y=.1x-.2$

$y=\frac{1}{10}x-\frac{1}{5}$

Yes

e. $10y-x=-2$

$10y=x-2$

$y=\frac{1}{10}x-\frac{1}{5}$

Yes

f. $1+.5x=2+5y$

$5y=.5x-1$

$y=\frac{1}{10}x-\frac{1}{5}$

Yes

37. a. $x + y = 3$

$y = -x + 3$

$m = -1, b = 3$

L_3

b. $2x - y = -2$

$-y = -2x - 2$

$y = 2x + 2$

$m = 2, b = 2$

L_1

c. $x = 3y + 3$

$3y = x - 3$

$y = \frac{1}{3}x - 1$

$m = \frac{1}{3},\ b = -1$

L_2

38. a. No; $5 + 4 \neq 3$

b. No; $2 \neq 1 - 1$

c. Yes; $2(2) = 1 + 3$ and $2(4) = 5 + 3$

39. $y = 30x + 72$

a. When x = 0, y = 72. This is the temperature of the water at time = 0 before the kettle is turned on.

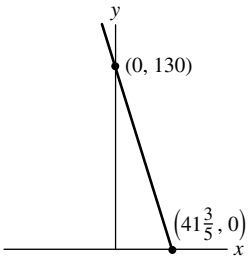
b. $y = 30(3) + 72$

$y = 162^{\circ}F$

c. Water boils when y = 212 so we have $212 = 30x + 72$. Solving for x gives $x = 4\frac{2}{3}$ minutes or 4 minutes 40 seconds.

40. a. *x*-intercept: $\left(41\frac{3}{5}, 0\right)$

y-intercept: (0, 130)



b. In 1969 there were 130,000 square miles of rain forest.

c. $80 = \left(-\frac{25}{8}\right)x + 130$

$x = 16$

1969 + 16 = 1985

d. $2007 - 1969 = 38$

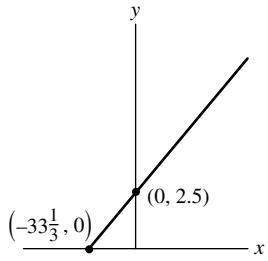
$y = \left(-\frac{25}{8}\right)(38) + 130$

$y = 11.25$

There were 11,250 square miles of rain forest remaining in 2007.

41. a. *x*-intercept: $\left(-33\frac{1}{3}, 0\right)$

y-intercept: (0, 2.5)



b. In 1960, 2.5 trillion cigarettes were sold.

c. $4 = .075x + 2.5$

$x = 20$

1960 + 20 = 1980

d. 2020 – 1960 = 60

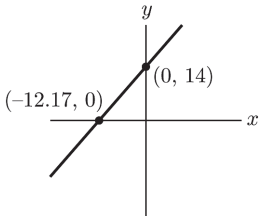
$y = .075(60) + 2.5$

$y = 7$

7 trillion

42. a. *x*-intercept: (–12.17, 0)

y-intercept: (0, 14)

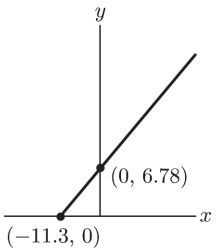


b. In 2000 the income from ecotourism was $14,000.

c. $20 = 1.15x + 14$
$x \approx 5.22$
$2000 + 5.22 = 2005.22$
The year 2005.

d. $2016 - 2000 = 16$
$y = 1.15(16) + 14$
$y = 32.4$
\$32,400

43. a. x-intercept: (–11.3, 0)
y-intercept: (0, 678)

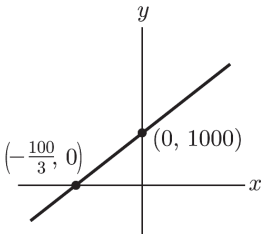


b. In 1997 the car insurance rate for a small car was \$678.

c. $2000 - 1997 = 3$
$y = 60(3) + 678$
$y = 858$
\$858

d. $1578 = 60x + 678$
$x = 15$
$1997 + 15 = 2012$
The year 2012

44. a. x-intercept: $\left(-\frac{100}{3}, 0\right)$
y-intercept: (0, 1000)



b. $y = 30(2) + 1000$
$y = 60 + 1000$
$y = 1060$
\$1060 will be in the account after 2 years.

c. $1180 = 30x + 1000$
$180 = 30x$
$x = 6$
The balance will be \$1180 after 6 years.

45. a. In 2000, 3.9% of entering college freshmen intended to major in biology.

b. $2011 - 2000 = 11$
$y = 0.2(11) + 3.9$
$y = 6.1$
6.1% of college freshmen in 2011 intended to major in biology. The actual value is close to the predicted value.

c. $5.3 = 0.2x + 3.9$
$x = 7$
$2000 + 7 = 2007$
In 2007, the percent of college freshmen that intended to major in biology was 5.3.

46. a. In 2000, 9.7% of college freshmen smoked.

b. $2004 - 2000 = 4$
$y = -0.65(4) + 9.7$
$y = 7.1$
7.1% of college freshmen smoked in 2004.

c. $4.5 = -0.65x + 9.7$
$x = 8$
$2000 + 8 = 2008$
In 2008, the percent of college freshmen that smoked was 4.5.

47. a. $2008 - 2000 = 8$
$y = 787(8) + 10600$
$y = 16896$
\$16,896 will be the approximate average tuition in 2008.

b. $24000 = 787x + 10600$
$x \approx 17$
$2000 + 17 = 2017$
In 2017, the approximate average cost of tuition will be \$24,000.

48. a. $2007-2000=7$
$y=556(7)+11522$
$y=15414$
15,414 bachelor degrees in mathematics and statistics were awarded in 2007.

b. $22000=556x+11522$
$x\approx 19$
$2000+19=2019$
In 2019, there will be approximately 22,000 bachelor degrees in mathematics and statistics awarded.

49. $y=mx+b$
$8=m(0)+b$
$b=8$
$0=m(16)+8$
$m=-\frac{1}{2}$
$y=-\frac{1}{2}x+8$

50. $y=mx+b$
$.9=m(0)+b$
$b=.9$
$0=m(.6)+.9$
$m=-1.5$
$y=-1.5x+.9$

51. $y=mx+b$
$5=m(0)+b$
$b=5$
$0=m(4)+5$
$m=-\frac{5}{4}$
$y=-\frac{5}{4}x+5$

52. Since the equation is parallel to the *y* axis, it will be in the form *x* = a. Therefore the equation will be x = 5.

53. On the *x*-axis, *y* = 0.

54. No, because two straight lines (the graphed line and the *x*-axis) cannot intersect more than once.

55. The equation of a line parallel to the *y* axis will be in the form *x* = a**.**

56. y = b is an equation of a line parallel to the x-axis.

57. $2x-y=-3$

58. $1\cdot x+0\cdot y=5$

59. $1\cdot x+0\cdot y=-3$

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

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

62. $4x-y=\frac{5}{6}$
$24x-6y=5$

63. Since (a,0) and (0,b) are points on the line the slope of the line is (b-0)/(0-a) = -b/a. Since the y intercept is (0,b), the equation of the line is $y=-(b/a)x+b$ or $ay=-bx+ab.$ In general form, the equation is bx + ay = ab.

64. If (5, 0) and (0, 6) are on the line, then a = 5 and b = 6. Substituting these values into the equation bx + ay = ab gives 6x + 5y = 30.

65. One possible equation is $y=x-9.$

66. One possible equation is $y=x+10.$

67. One possible equation is $y=x+7.$

68. One possible equation is $y=x-6.$

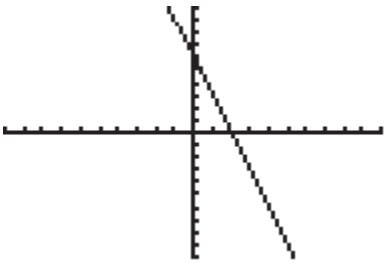
69. One possible equation is $y=x+2.$

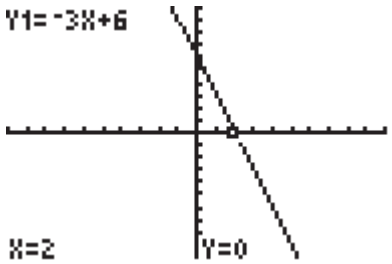
70. One possible equation is $y=x.$

71. One possible equation is $y=x+9.$

72. One possible equation is $y=x-5.$

73. **a.** y = –3x + 6

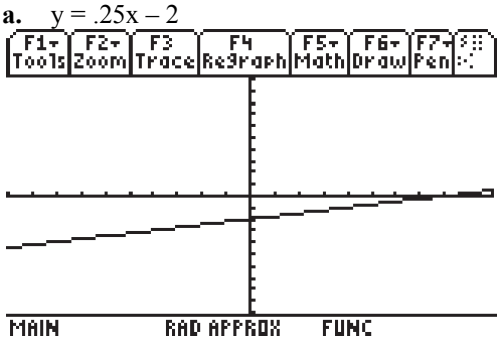




b. The intercepts are at the points (2, 0) and (0, 6)

c. When $x = 2$, $y = 0$

74. **a.** y = .25x – 2



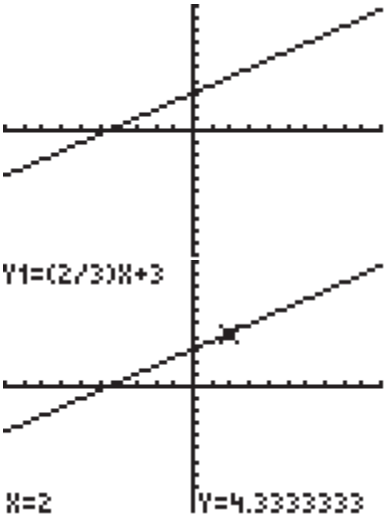
b. (0, –2) and (8,0) are intercepts

c. When x = 2, y = –1.5.

75. **a.** $3y - 2x = 9$

$$3y = 2x + 9$$

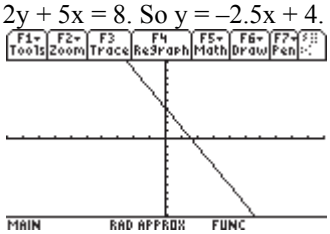
$$y = \frac{2}{3}x + 3$$



b. The intercepts are at the points (–4.5, 0) and (0, 3).

c. When $x = 2$, $y = 4.33$ or 13 / 3.

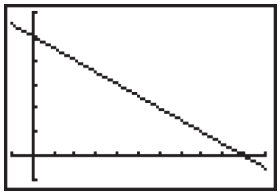
76. **a.** 2y + 5x = 8. So y = –2.5x + 4.



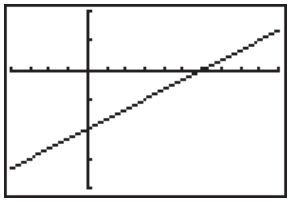
b. The intercepts are (0, 4) and (1.6, 0).

c. When x = 2 then y = –1.

77. 2y + x = 100. When y = 0, x = 100, and when x = 0, y = 50. An appropriate window might be [-10, 110] and [-10,60]. Other answers are possible.



78. x – 3y = 60. When x = 0, then y = - 20 and when y = 0 x = 60. An appropriate window might be [-40, 100] and [-40 , 20] but other answers are equally correct.



Exercises 1.2

1. False

2. True

3. True

4. False

5. $2x - 5 \geq 3$

$2x \geq 8$

$x \geq 4$

6. $3x - 7 \le 2$
$3x \le 9$
$x \le 3$

7. $-5x + 13 \le -2$
$-5x \le -15$
$x \ge 3$

8. $-x + 1 \le 3$
$-x \le 2$
$x \ge -2$
(d)

9. $2x + y \le 5$
$y \le -2x + 5$

10. $-3x + y \ge 1$
$y \ge 3x + 1$

11. $5x - \frac{1}{3}y \le 6$
$-\frac{1}{3}y \le -5x + 6$
$y \ge 15x - 18$

12. $\frac{1}{2}x - y \le -1$
$-y \le -\frac{1}{2}x - 1$
$y \ge \frac{1}{2}x + 1$

13. $4x \ge -3$
$x \ge -\frac{3}{4}$

14. $-2x \le 4$
$x \ge -2$

15. $3(2) + 5(1) \le 12$
$6 + 5 \le 12$
$11 \le 12$
Yes

16. $-2(3) + 15 \ge 9$
$-6 + 15 \ge 9$
$9 \ge 9$
Yes

17. $0 \ge -2(3) + 7$
$0 \ge -6 + 7$
$0 \ge 1$
No

18. $6 \le \frac{1}{2}(4) + 3$
$6 \le 2 + 3$
$6 \le 5$
No

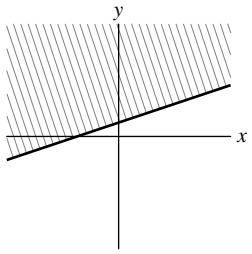
19. $5 \le 3(3) - 4$
$5 \le 9 - 4$
$5 \le 5$
Yes

20. $-2 \ge -3$
Yes

21. $7 \ge 5$
Yes

22. $0 \le 7$
Yes

23.



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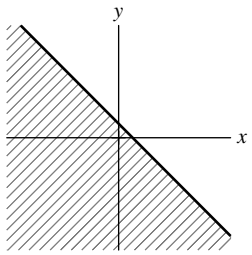

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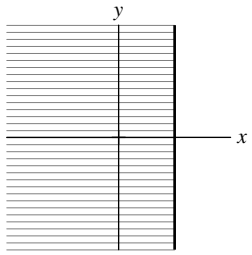

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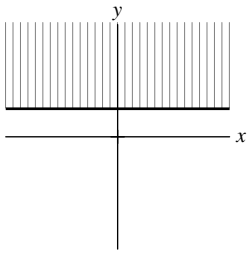

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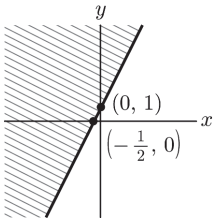

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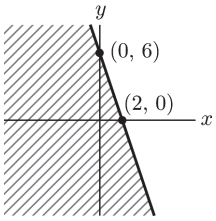

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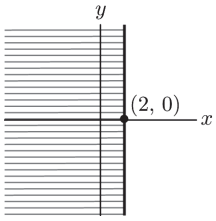

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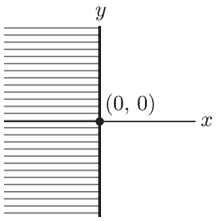
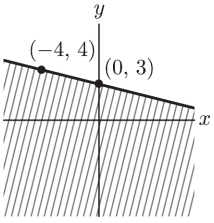


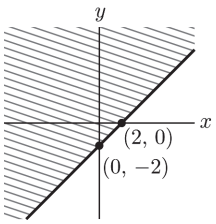
31. $x + 4y \geq 12$

$$y \geq -\frac{1}{4}x + 3$$



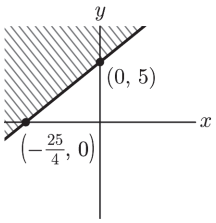
32. $4x - 4y \geq 8$

$$y \leq x - 2$$



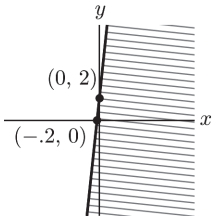
33. $4x - 5y + 25 \geq 0$

$$y \leq \frac{4}{5}x + 5$$



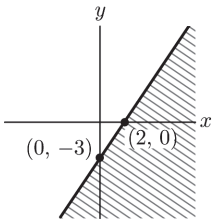
34. $.1y - x = .2$

$$y \geq 10x + 2$$



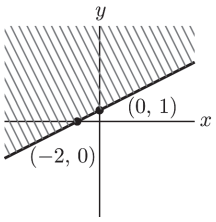
35. $\frac{1}{2}x - \frac{1}{3}y \leq 1$

$$y \geq \frac{3}{2}x - 3$$



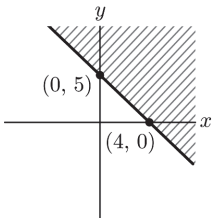
36. $3y+\frac{1}{2}x \le 2y+x+1$

$y \le \frac{1}{2}x+1$



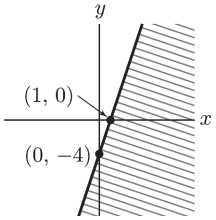
37. $.5x+.4y \le 2$

$y \le -1.25x+5$

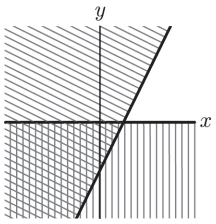


38. $y-2x \ge \frac{1}{2}y-2$

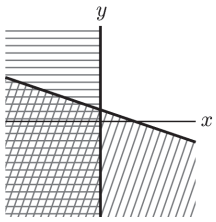
$y \ge 4x-4$



39. $\begin{cases} y \le 2x-4 \\ y \ge 0 \end{cases}$

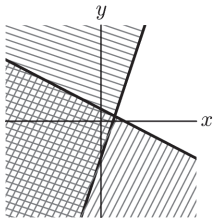


40. $\begin{cases} y \ge -\frac{1}{3}x+1 \\ x \ge 0 \end{cases}$



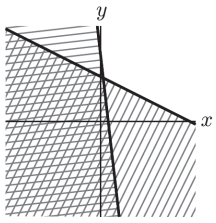
41. $\begin{cases} x+2y \ge 2 \\ 3x-y \ge 3 \end{cases}$

$\begin{cases} y \ge -\frac{1}{2}x+1 \\ y \le 3x-3 \end{cases}$



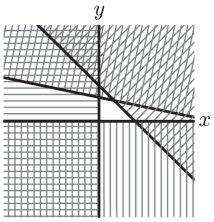
42. $\begin{cases} 3x+6y \ge 24 \\ 3x+y \ge 6 \end{cases}$

$\begin{cases} y \ge -\frac{1}{2}x+4 \\ y \ge -3x+6 \end{cases}$



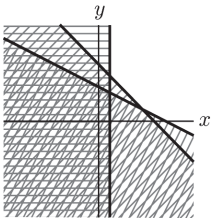
43. $\begin{cases} x+5y \le 10 \\ x+y \le 3 \\ x \ge 0,\ y \ge 0 \end{cases}$

$\begin{cases} y \le -\frac{1}{5}x+2 \\ y \le -x+3 \\ x \ge 0,\ y \ge 0 \end{cases}$



44. $\begin{cases} x+2y \ge 6 \\ x+y \ge 5 \\ x \ge 1 \end{cases}$

$\begin{cases} y \ge -\frac{1}{2}x+3 \\ y \ge -x+5 \\ x \ge 1 \end{cases}$



45. $\begin{cases} 6(8)+3(7) \le 96 \\ 8+7 \le 18 \\ 2(8)+6(7) \le 72 \\ 8 \ge 0,\ 7 \ge 0 \end{cases}$

$\begin{cases} 69 \le 96 \\ 15 \le 18 \\ 58 \le 72 \\ 8 \ge 0,\ 7 \ge 0 \end{cases}$

Yes

46. $\begin{cases} 6(14)+3(3) \le 96 \\ 14+3 \le 18 \\ 2(14)+6(3) \le 72 \\ 14 \ge 0,\ 3 \ge 0 \end{cases}$

$\begin{cases} 93 \le 96 \\ 17 \le 18 \\ 46 \le 72 \\ 14 \ge 0,\ 3 \ge 0 \end{cases}$

Yes

47. $\begin{cases} 6(9)+3(10) \le 96 \\ 9+10 \le 18 \\ 2(9)+6(10) \le 72 \\ 9 \ge 0,\ 10 \ge 0 \end{cases}$

$\begin{cases} 84 \le 96 \\ 19 \le 18 \\ 78 \le 72 \\ 9 \ge 0,\ 10 \ge 0 \end{cases}$

No

48. $\begin{cases} 6(16)+3(0) \le 96 \\ 16+0 \le 18 \\ 2(16)+6(0) \le 72 \\ 16 \ge 0,\ 0 \ge 0 \end{cases}$

$\begin{cases} 96 \le 96 \\ 16 \le 18 \\ 32 \le 72 \\ 16 \ge 0,\ 0 \ge 0 \end{cases}$

Yes

49. For $x = 3$, $y = 2(3) + 5 = 11$.
So (3, 9) is below.

50. $3x - y = 4$
$y = 3x - 4$
For $x = 2$, $y = 3(2) - 4 = 2$.
So (2, 3) is above.

51. $7 - 4x + 5y = 0$

$$y = \frac{4}{5}x - \frac{7}{5}$$

For $x = 0$, $y = \frac{4}{5}(0) - \frac{7}{5} = -\frac{7}{5}$.
So (0, 0) is above.

52. $x = 2y + 5$

$y = \frac{1}{2}x - \frac{5}{2}$

For $x = 6$, $y = \frac{1}{2}(6) - \frac{5}{2} = \frac{1}{2}$.

So (6, 1) is above.

53. $8x - 4y = 4$

$y = 2x - 1$

$8x - 4y = 0$

$y = 2x$

$\begin{cases} y \geq 2x - 1 \\ y \leq 2x \end{cases}$

54. e

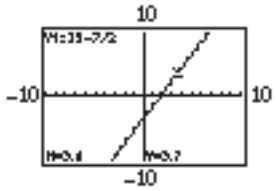
55. d

56. d

57. $4x - 2y = 7$

$y = 2x - \frac{7}{2}$

a.



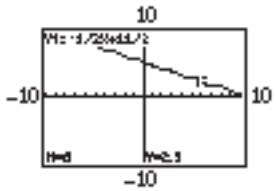
(3.6, 3.7)

b. Below, because (3.6, 3.7) is on the line.

58. $x + 2y = 11$

$y = -\frac{1}{2}x + \frac{11}{2}$

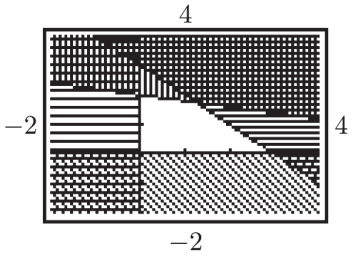
a.



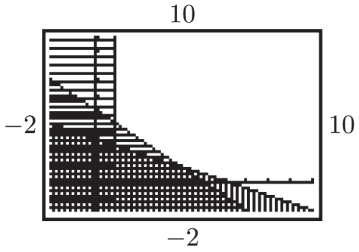
(6, 2.5)

b. Above, because (6, 2.5) is on the line.

59.



60.



Exercises 1.3

1. $4x - 5 = -2x + 7$

$6x = 12$

$x = 2$

$y = 4(2) - 5 = 3$

(2, 3)

2. $3x - 15 = -2x + 10$

$5x = 25$

$x = 5$

$y = 3(5) - 15 = 0$

(5, 0)

3. $x = 4y - 2$

$x = -2y + 4$

$4y - 2 = -2y + 4$

$6y = 6$

$y = 1$

$x = 4(1) - 2 = 2$

(2, 1)

4. $\begin{cases} 2x - 3y = 3 \\ y = 3 \end{cases}$

$x = \frac{3}{2}y + \frac{3}{2} = \frac{3}{2}(3) + \frac{3}{2} = 6$

(6, 3)

5. $y = \frac{1}{3}(12) - 1 = 3$

(12, 3)

6. $\begin{cases} 2x - 3y = 3 \\ x = 6 \end{cases}$

$y = \frac{2}{3}x - 1 = \frac{2}{3}(6) - 1 = 3$

(6, 3)

7. $\begin{cases} 6 - 3(4) = -6 \\ 3(6) - 2(4) = 10 \end{cases}$

$\begin{cases} -6 = -6 \\ 10 = 10 \end{cases}$

Yes

8. $\begin{cases} 4 = \frac{1}{3}(12) - 1 \\ 12 = 12 \end{cases}$

$\begin{cases} 4 = 3 \\ 12 = 12 \end{cases}$

No

9. $\begin{cases} y = -2x + 7 \\ y = x - 3 \end{cases}$

$-2x + 7 = x - 3$

$-3x = -10$

$x = \frac{10}{3}$

$y = \frac{10}{3} - 3 = \frac{1}{3}$

$x = \frac{10}{3}$, $y = \frac{1}{3}$

10. $\begin{cases} y = -\frac{1}{2}x + 2 \\ y = -x + 6 \end{cases}$

$-\frac{1}{2}x + 2 = -x + 6$

$\frac{1}{2}x = 4$

$x = 8$

$y = -(8) + 6 = -2$

$x = 8, y = -2$

11. $\begin{cases} y = \frac{5}{2}x - \frac{1}{2} \\ y = -2x - 4 \end{cases}$

$\frac{5}{2}x - \frac{1}{2} = -2x - 4$

$\frac{9}{2}x = -\frac{7}{2}$

$x = -\frac{7}{9}$

$y = -2\left(-\frac{7}{9}\right) - 4 = -\frac{22}{9}$

$x = -\frac{7}{9}$, $y = -\frac{22}{9}$

12. $\begin{cases} y = -\frac{1}{2}x + 3 \\ y = 3x - 12 \end{cases}$

$-\frac{1}{2}x + 3 = 3x - 12$

$-\frac{7}{2}x = -15$

$x = \frac{30}{7}$

$y = -\frac{1}{2}\left(\frac{30}{7}\right) + 3 = \frac{6}{7}$

$x = \frac{30}{7}$, $y = \frac{6}{7}$

13. $\begin{cases} x = 3 \\ 2x + 3y = 18 \end{cases}$

$y = -\frac{2}{3}x + 6 = -\frac{2}{3}(3) + 6 = 4$

$A = (3, 4)$

$\begin{cases} y = 2 \\ 2x + 3y = 18 \end{cases}$

$x = -\frac{3}{2}y + 9 = -\frac{3}{2}(2) + 9 = 6$

$B = (6, 2)$

14. $\begin{cases} y = -\frac{1}{3}x + 7 \\ x = 0 \end{cases}$

$y = -\frac{1}{3}(0) + 7 = 7$

$A = (0, 7)$

$\begin{cases} y = -\frac{1}{3}x + 7 \\ y = -x + 9 \end{cases}$

$-\frac{1}{3}x + 7 = -x + 9$

$\frac{2}{3}x = 2$

$x = 3$

$y = -(3) + 9 = 6$

$B = (3, 6)$

$\begin{cases} y = -x + 9 \\ y = -3x + 19 \end{cases}$

$-x + 9 = -3x + 19$

$2x = 10$

$x = 5$

$y = -(5) + 9 = 4$

$C = (5, 4)$

$\begin{cases} y = -3x + 19 \\ y = 0 \end{cases}$

$-3x + 19 = 0$

$-3x = -19$

$x = \frac{19}{3}$

$D = \left(\frac{19}{3}, 0\right)$

15. $A = (0, 0)$

$\begin{cases} y = 2x \\ y = \frac{1}{2}x + 3 \end{cases}$

$2x = \frac{1}{2}x + 3$

$x = 2$

$y = 2(2) = 4$

$B = (2, 4)$

$\begin{cases} y = \frac{1}{2}x + 3 \\ x = 5 \end{cases}$

$y = \frac{1}{2}(5) + 3 = \frac{11}{2}$

$C = \left(5, \frac{11}{2}\right)$

$D = (5, 0)$

16. $\begin{cases} x = 0 \\ 2x + y = 14 \end{cases}$

$y = -2x + 14 = -2(0) + 14 = 14$

$A = (0, 14)$

$\begin{cases} 2x + y = 14 \\ 3x + 2y = 24 \end{cases}$

$\begin{cases} y = -2x + 14 \\ y = -\frac{3}{2}x + 12 \end{cases}$

$-2x + 14 = -\frac{3}{2}x + 12$

$-\frac{1}{2}x = -2$

$x = 4$

$y = -2(4) + 14 = 6$

$B = (4, 6)$

$\begin{cases} 3x + 2y = 24 \\ x + 2y = 12 \end{cases}$

$\begin{cases} y = -\frac{3}{2}x + 12 \\ y = -\frac{1}{2}x + 6 \end{cases}$

$-\frac{3}{2}x + 12 = -\frac{1}{2}x + 6$

$-x = -6$

$x = 6$

$y = -\frac{1}{2}(6) + 6 = 3$

$C = (6, 3)$

$\begin{cases} x + 2y = 12 \\ y = 0 \end{cases}$

$x = -2y + 12 = -2(0) + 12 = 12$

$D = (12, 0)$

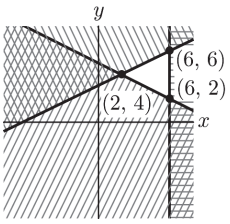
17. $\begin{cases} 2y - x \le 6 \\ x + 2y \ge 10 \\ x \le 6 \end{cases}$

$\begin{cases} y \le \frac{1}{2}x + 3 \\ y \ge -\frac{1}{2}x + 5 \\ x \le 6 \end{cases}$

$\begin{cases} y = \frac{1}{2}x + 3 \\ y = -\frac{1}{2}x + 5 \end{cases} \Rightarrow (2, 4)$

$\begin{cases} y = -\frac{1}{2}x + 5 \\ x = 6 \end{cases} \Rightarrow (6, 2)$

$\begin{cases} y = \frac{1}{2}x + 3 \\ x = 6 \end{cases} \Rightarrow (6, 6)$

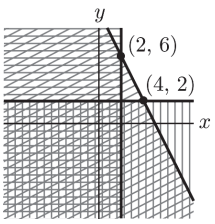


18. $\begin{cases} 2x + y \ge 10 \\ x \ge 2 \\ y \ge 2 \end{cases}$

$\begin{cases} y \ge -2x + 10 \\ x \ge 2 \\ y \ge 2 \end{cases}$

$\begin{cases} y = -2x + 10 \\ x = 2 \end{cases} \Rightarrow (2, 6)$

$\begin{cases} y = -2x + 10 \\ y = 2 \end{cases} \Rightarrow (4, 2)$



19. $\begin{cases} x + 3y \le 18 \\ 2x + y \le 16 \\ x \ge 0,\ y \ge 0 \end{cases}$

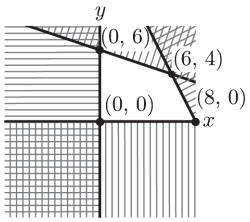
$\begin{cases} y \le -\frac{1}{3}x + 6 \\ y \le -2x + 16 \\ x \ge 0,\ y \ge 0 \end{cases}$

$\begin{cases} y = -\frac{1}{3}x + 6 \\ y = -2x + 16 \end{cases} \Rightarrow (6, 4)$

$\begin{cases} y = -\frac{1}{3}x + 6 \\ x = 0 \end{cases} \Rightarrow (0, 6)$

$\begin{cases} y = -2x + 16 \\ y = 0 \end{cases} \Rightarrow (8, 0)$

$\begin{cases} x = 0 \\ y = 0 \end{cases} \Rightarrow (0, 0)$



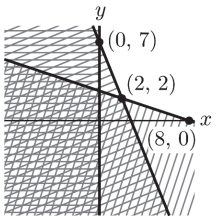
20. $\begin{cases} 5x + 2y \ge 14 \\ x + 3y \ge 8 \\ x \ge 0,\ y \ge 0 \end{cases}$

$\begin{cases} y \ge -\frac{5}{2}x + 7 \\ y \ge -\frac{1}{3}x + \frac{8}{3} \\ x \ge 0,\ y \ge 0 \end{cases}$

$\begin{cases} y = -\frac{5}{2}x + 7 \\ y = -\frac{1}{3}x + \frac{8}{3} \end{cases} \Rightarrow (2, 2)$

$\begin{cases} y = -\frac{5}{2}x + 7 \\ x = 0 \end{cases} \Rightarrow (0, 7)$

$$\begin{cases} y = -\frac{1}{3}x + \frac{8}{3} \\ y = 0 \end{cases} \Rightarrow (8, 0)$$



21. $\begin{cases} 4x + y \geq 8 \\ x + y \geq 5 \\ x + 3y \geq 9 \\ x \geq 0,\ y \geq 0 \end{cases}$

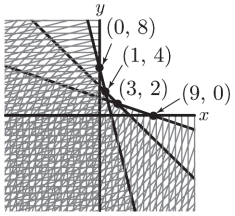
$$\begin{cases} y \geq -4x + 8 \\ y \geq -x + 5 \\ y \geq -\frac{1}{3}x + 3 \\ x \geq 0,\ y \geq 0 \end{cases}$$

$$\begin{cases} y = -4x + 8 \\ y = -x + 5 \end{cases} \Rightarrow (1, 4)$$

$$\begin{cases} y = -x + 5 \\ y = -\frac{1}{3}x + 3 \end{cases} \Rightarrow (3, 2)$$

$$\begin{cases} y = -\frac{1}{3}x + 3 \\ y = 0 \end{cases} \Rightarrow (9, 0)$$

$$\begin{cases} y = -4x + 8 \\ x = 0 \end{cases} \Rightarrow (0, 8)$$



22. $\begin{cases} x + 4y \leq 28 \\ x + y \leq 10 \\ 3x + y \leq 24 \\ x \geq 0,\ y \geq 0 \end{cases}$

$$\begin{cases} y \leq -\frac{1}{4}x + 7 \\ y \leq -x + 10 \\ y \leq -3x + 24 \\ x \geq 0,\ y \geq 0 \end{cases}$$

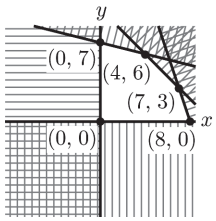
$$\begin{cases} y = -\frac{1}{4}x + 7 \\ x = 0 \end{cases} \Rightarrow (0, 7)$$

$$\begin{cases} y = -\frac{1}{4}x + 7 \\ y = -x + 10 \end{cases} \Rightarrow (4, 6)$$

$$\begin{cases} y = -x + 10 \\ y = -3x + 24 \end{cases} \Rightarrow (7, 3)$$

$$\begin{cases} y = -3x + 24 \\ y = 0 \end{cases} \Rightarrow (8, 0)$$

$$\begin{cases} x = 0 \\ y = 0 \end{cases} \Rightarrow (0, 0)$$



23. **a.** $p = .0001(19{,}500) + .05$
$= \$2.00$

b. $p = .0001(0) + .05$
$= \$.05$
No units will be supplied for $.05 or less.

24. **a.** $p = -.001(31{,}500) + 32.5$
$= \$1.00$

b. $-.001q + 32.5 \leq 0$
$q \geq 32{,}500$ units

25. $\begin{cases} p = .0001q + .05 \\ p = -.001q + 32.5 \end{cases}$

$.0001q + 0.05 = -.001q + 32.5$

$.0011q = 32.45$

$q = 29{,}500$ units

$p = .0001(29{,}500) + .05$

$p = \$3.00$

26. $p = \frac{1}{300}q + 13$

$p = -.03q + 19$

$\frac{1}{300}q + 13 = -.03q + 19$

$\frac{1}{30}q = 6$

$q = 180$ books

$p = -.03(180) + 19$

$p = \$13.60$

27. a. $p = -.15q + 6.925$

$5.80 = -.15q + 6.925$

$-1.125 = -.15q$

$7.5 = q$

$p = .2q + 3.6$

$5.80 = .2q + 3.6$

$2.2 = .2q$

$11 = q$

Demand will be 7.5 billion bushels and supply will be 11 billion bushels

b. The equilibrium point occurs when supply is the same as demand. Therefore,

$-.15q + 6.925 = .2q + 3.6$

$-.35q = -3.325$

$q = 9.5$

To find the equilibrium price, substitute the value into either equation.

$p = -.15(9.5) + 6.925$

$p = -1.425 + 6.925$

$p = 5.5$

Equilibrium occurs when 9.5 billion bushels are produced and sold for \$5.50 per bushel.

28. a. $p = -2.2q + 19.36$

$16.50 = -2.2q + 19.36$

$-2.86 = -2.2q$

$1.3 = q$

$p = 1.5q + 9$

$16.50 = 1.5q + 9$

$7.50 = 1.5q$

$5 = q$

Demand will be 1.3 billion bushels and supply will be 5 billion bushels

b. The equilibrium point occurs when supply is the same as demand. Therefore,

$-2.2q + 19.36 = 1.5q + 9$

$-3.7q = -10.36$

$q = 2.8$

To find the equilibrium price, substitute the value into either equation.

$p = -2.2(2.8) + 19.36$

$p = -6.16 + 19.36$

$p = 13.20$

Equilibrium occurs when 2.8 billion bushels are produced and sold for \$13.20 per bushel

29. Let $C = F$, then

$C = \frac{5}{9}(F - 32)$

$F = \frac{5}{9}(F - 32)$

$\frac{9F}{5} = F - 32$

$\frac{4F}{5} = -32$

$F = -40$

Therefore, when the temperature is -40°, it will be the same on both temperature scales.

30. a. $F = \frac{9}{5}(5) + 32$

$F = 41$

$F = 2(5) + 30$

$F = 40$

The two temperatures differ by 1 degree.

b. $F = \frac{9}{5}(20) + 32$

$F = 68$

$F = 2(20) + 30$

$F = 70$

The two temperatures differ by 2 degrees.

c. $2C + 30 = \frac{9}{5}C + 32$

$\frac{1}{5}C = 2$

$C = 10$

When the temperature is 10 degrees Celsius, the two formulas will give the same Fahrenheit temperature.

31. Let x = numbers of shirts and y = cost of manufacture.

$\begin{cases} y = 1200 + 30x \\ y = 500 + 35x \end{cases}$

$1200 + 30x = 500 + 35x$

$-5x = -700$

$x = 140$

$y = 1200 + 30x$

$y = 1200 + 30(140)$

$y = 1200 + 4200$

$y = 5400$

The manufactures will charge the same \$5400 if they produce 140 shirts.

32. Let x = hours working and y = hours supervising.

$\begin{cases} x + y = 40 \\ 12x + 15y = 504 \end{cases}$

$\begin{cases} y = -x + 40 \\ y = -\frac{4}{5}x + \frac{168}{5} \end{cases}$

$-x + 40 = -\frac{4}{5}x + \frac{168}{5}$

$-\frac{1}{5}x = -\frac{32}{5}$

$x = 32$

$y = -32 + 40 = 8$

Working: 32; supervising: 8

33. Method A: $y = .45 + .01x$

Method B: $y = .035x$

Intersection point:

$.45 + .01x = .035x$

$.45 = .025x$

$18 = x$

For a call lasting 18 minutes, the costs for either method will be the same, $y = .035(18) = 63$. The cost will be 63cents.

34. Let x = numbers of miles towed and y = cost of the tow.

$\begin{cases} y = 50 + 3x \\ y = 60 + 2.5x \end{cases}$

$50 + 3x = 60 + 2.5x$

$0.5x = 10$

$x = 20$

$y = 50 + 3x$

$y = 50 + 3(20)$

$y = 50 + 60$

$y = 110$

The two companies will charge the same \$110 if they tow a car 20 miles.

35. $\begin{cases} 3x - y = 3 \\ x + y = 5 \\ y = 0 \end{cases}$

$\begin{cases} y = 3x - 3 \\ y = -x + 5 \\ y = 0 \end{cases}$

$\begin{cases} y = 3x - 3 \\ y = -x + 5 \end{cases} \Rightarrow (2, 3)$

$\begin{cases} y = -x + 5 \\ y = 0 \end{cases} \Rightarrow (5, 0)$

$\begin{cases} y = 3x - 3 \\ y = 0 \end{cases} \Rightarrow (1, 0)$

Based on the above points of intersection, the base of the triangle is $5 - 1 = 4$ and the height is 3. Therefore the area of the triangle, in square units, is:

$A = \frac{1}{2}bh$

$A = \frac{1}{2}(4)(3)$

$A = 6$

36. $\begin{cases} 3x + 4y = 24 \\ 2x - 4y = -4 \\ x = 0 \end{cases}$

$\begin{cases} y = -\frac{3}{4}x + 6 \\ y = \frac{1}{2}x + 1 \\ x = 0 \end{cases}$

$\begin{cases} y = -\frac{3}{4}x + 6 \\ y = \frac{1}{2}x + 1 \end{cases} \Rightarrow (4, 3)$

$\begin{cases} y = -\frac{3}{4}x + 6 \\ x = 0 \end{cases} \Rightarrow (0, 6)$

$\begin{cases} y = \frac{1}{2}x + 1 \\ x = 0 \end{cases} \Rightarrow (0, 1)$

Based on the above points of intersection, the base of the triangle is $6 - 1 = 5$ and the height is 4. Therefore the area of the triangle, in square units is:

$A = \frac{1}{2}bh$

$A = \frac{1}{2}(5)(4)$

$A = 10$

37. Let x = weight of first contestant
y = weight of second contestant

$\begin{cases} x + y = 700 \\ 2x = 275 + y \end{cases}$

$\begin{cases} y = 700 - x \\ y = 2x - 275 \end{cases}$

$700 - x = 2x - 275$

$975 = 3x$

$x = 325$ pounds

Answer (c) is correct.

38. Let x = number of 32" TVs sold
y = number of 40" TVs sold

$\begin{cases} y = x + 5 \\ 280x + 400y = 15600 \end{cases}$

$\begin{cases} y = x + 5 \\ y = -\frac{7}{10}x + 39 \end{cases}$

$x + 5 = -\frac{7}{10}x + 39$

$\frac{17}{10}x = 34$

$x = 20$ TV sets

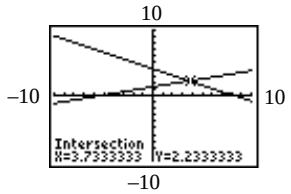
$y = 20 + 5$

$= 25$ TV sets

Total = 20 + 25 = 45 TV sets

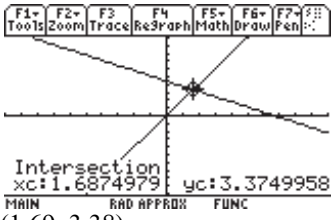
Answer (d) is correct.

39.



(3.73, 2.23)

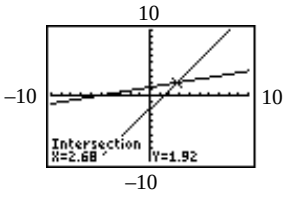
40.



(1.69, 3.38)

41. $\begin{cases} x-4y=-5 \\ 3x-2y=4.2 \end{cases}$

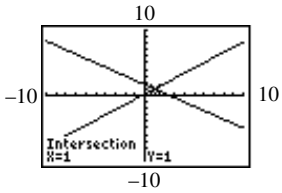
$\begin{cases} y=\frac{1}{4}x+\frac{5}{4} \\ y=\frac{3}{2}x-2.1 \end{cases}$



(2.68, 1.92)

42. $\begin{cases} 2x+3y=5 \\ -4x+5y=1 \end{cases}$

$\begin{cases} y=-\frac{2}{3}x+\frac{5}{3} \\ y=\frac{4}{5}x+\frac{1}{5} \end{cases}$

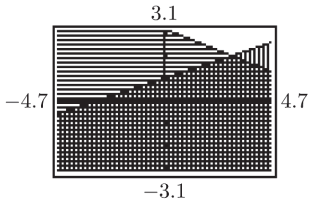


(1, 1)

43. $\begin{cases} -x+3y \geq 3 \\ .4x+y \geq 3.2 \end{cases}$

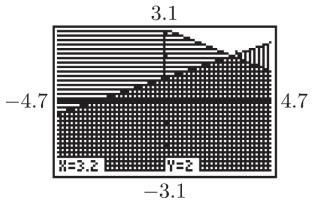
$\begin{cases} y \geq \frac{1}{3}x+1 \\ y \geq -.4x+3.2 \end{cases}$

a.



b. (3, 2)

c.



d. $\begin{cases} -(3.2)+3(2) \geq 3 \\ .4(3.2)+2 \geq 3.2 \end{cases}$

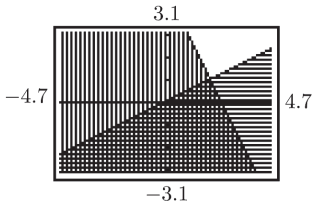
$\begin{cases} 2.8 \geq 3 \\ 3.28 \geq 3.2 \end{cases}$

No

44. $\begin{cases} 2x+y \geq 5 \\ x-2y \leq 0 \end{cases}$

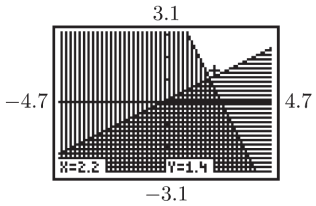
$\begin{cases} y \geq -2x+5 \\ y \geq \frac{1}{2}x \end{cases}$

a.



b. (2, 1)

c.



d. Yes

Exercises 1.4

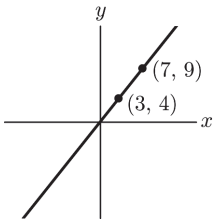
1. $m = \frac{2}{3}$

2. $y = 0x - 4$
$m = 0$

3. $y - 3 = 5(x + 4)$
$y = 5x + 23$
$m = 5$

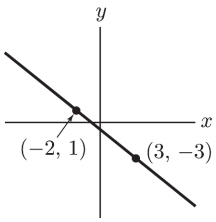
4. $7x + 5y = 10$
$y = -\frac{7}{5}x + 2$
$m = -\frac{7}{5}$

5.



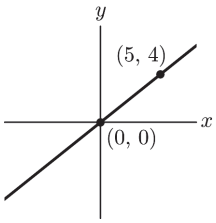
$m = \frac{9-4}{7-3} = \frac{5}{4}$

6.



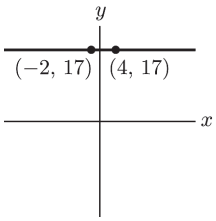
$m = \frac{-3-1}{3-(-2)} = -\frac{4}{5}$

7.



$m = \frac{4-0}{5-0} = \frac{4}{5}$

8.

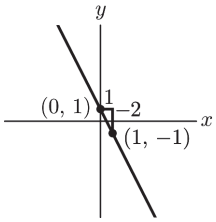


$m = \frac{17-17}{-2-4} = 0$

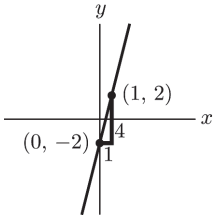
9. The slope of a vertical line is undefined.

10. The slope of a vertical line is undefined.

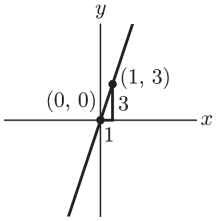
11.



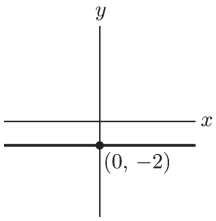
12.



13.



14.



15. $m = \frac{-2}{1} = -2$
$y - 3 = -2(x - 2)$
$y = -2x + 7$

16. $m = \frac{\frac{1}{2}}{1} = \frac{1}{2}$

$y - 1 = \frac{1}{2}(x - 3)$

$y = \frac{1}{2}x - \frac{1}{2}$

17. $m = \frac{0-2}{2-1} = -2$

$y - 0 = -2(x - 2)$

$y = -2x + 4$

18. $m = \frac{2 - \frac{1}{2}}{1-(-1)} = \frac{3}{4}$

$y - 2 = \frac{3}{4}(x - 1)$

$y = \frac{3}{4}x + \frac{5}{4}$

19. $m = -\frac{1}{-4} = \frac{1}{4}$

$y - 2 = \frac{1}{4}(x - 2)$

$y = \frac{1}{4}x + \frac{3}{2}$

20. $m = \frac{1}{3}$

$y - 3 = \frac{1}{3}(x - 5)$

$y = \frac{1}{3}x + \frac{4}{3}$

21. $m = -1$

$y - 0 = -1(x - 0)$

$y = -x$

22. $m = -\frac{1}{-\frac{1}{2}} = 2$

$y - (-1) = 2(x - 2)$

$y = 2x - 5$

23. $m = 0$

$y - 3 = 0(x - 2)$

$y = 3$

24. $m = 1.5$

$y - 0 = 1.5(x - 0)$

$y = 1.5x$

25. $y - 6 = \frac{3}{5}(x - 5)$

$y = \frac{3}{5}x + 3$

y-intercept: (0, 3)

26. $m = \frac{4-4}{0-1} = 0$

27. Let y = cost in dollars.
$y = 4x + 2000$

28. **a.** p-intercept: (0, 1200); at \$1200 no one will buy the item.

b. $0 = -3q + 1200$
$q = 400$ units
q-intercept: (400, 0); even if the item is given away, only 400 will be taken.

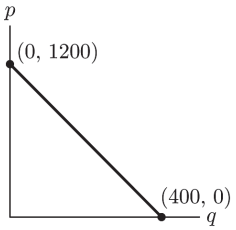
c. –3; to sell an additional item, the price must be reduced by \$3.

d. $p = -3(350) + 1200 = \$150$

e. $300 = -3q + 1200$

$q = 300$ items

f.



29. **a.** Let x = altitude and y = boiling point.

$m = \frac{212 - 202.8}{0 - 5000} = -.00184$

$y - 212 = -.00184(x - 0)$

$y = -.00184x + 212$

b. $y \approx -.00184x + 212$

$y \approx -.00184(29029) + 212$

$y \approx 158.6^{\circ}\text{F}$

30. a. $m = \dfrac{172-124}{80-68} = 4$

$c - 124 = 4(F - 68)$

$c = 4F - 148$

b. $F = \dfrac{1}{4}c + 37,$ so add 37 to the number of chirps counted in 15 seconds $\left(\dfrac{1}{4} \text{ of a minute}\right)$.

31. a. Let x = quantity and y = cost.

$m = \dfrac{9500-6800}{50-20} = 90$

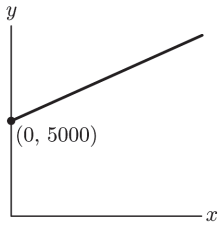
$y - 6800 = 90(x - 20)$

$y = 90x + 5000$

b. \$5000

c. \$90

d.



32. a. $y = 40(100) + 2400 = \$6400$

b. $3600 = 40x + 2400$

$x = 30$ coats

c. $y = 40(0) + 2400 = \$2400$

(0, 2400); even if no coats are made there is a cost for having the ability to make them.

d. 40; each additional coat costs \$40 to make.

33. a. $100(300) = \$30{,}000$

b. $6000 = 100x$

$x = 60$ coats

c. $y = 100(0) = 0$

(0, 0); if no coats are sold, there is no revenue.

d. 100; each additional coat yields an additional \$100 in revenue.

34. a. Profit = revenue – cost

$y = 100x - (40x + 2400)$

$y = 60x - 2400$

b. (0, –2400); if no coats are sold, \$2400 will be lost.

c. $0 = 60x - 2400$

$x = 40$

(40, 0); the break-even point is 40 coats. Less than 40 coats sold yields a loss, more than 40 yields a profit.

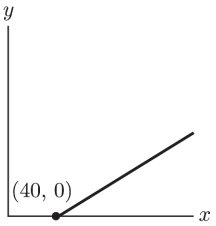
d. 60; each additional coat sold yields an additional \$60 profit.

e. $y = 60(80) - 2400 = \$2400$

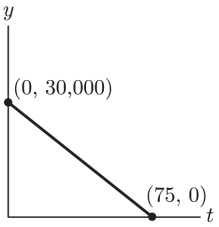
f. $6000 = 60x - 2400$

$x = 140$ coats

g.



35. a.



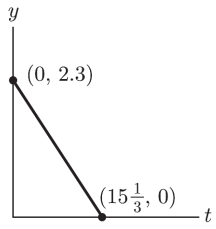
b. On February 1, 31 days have elapsed since January 1. The amount of oil y = 30,000 – 400(31) = 17,600 gallons.

c. On February 15, 45 days have elapsed since January 1. Therefore, the amount of oil would be y = 30,000- 400(45) = 12,000 gallons.

d. The significance of the y-intercept is that amount of oil present initially on January 1. This amount is 30,000 gallons.

e. The t-intercept is (75,0) and corresponds to the number of days at which the oil will be depleted.

36. a.



b. $y = 2.3 - .15(15) = \$.05$ million
\$50,000

c. (0, 2.3); \$2.3 million is the amount of cash reserves on July 1.

d. $0 = 2.3 - .15t$

$t = 15\frac{1}{3}$

$\left(15\frac{1}{3}, 0\right)$; the cash reserves will be depleted after $15\frac{1}{3}$ days.

e. $y = 2.3 - .15(3) = \$1.85$ million

f. $.8 = 2.3 - .15t$
$t = 10$
After 10 days, on July 11

37. a. $y = 0.10x + 220$

b. $y = 0.10(2000) + 220$
$y = 420$

c. $540 = 0.10x + 220$
$x = \$3200$

38. Each unit sold yields a commission of \$5. In addition, she receives \$60 per week base pay.

39. $m = -\frac{1}{2},\ b = 0$

$y = -\frac{1}{2}x$

40. $m = 3, b = -1$
$y = 3x - 1$

41. $m = -\frac{1}{3}$

$y - (-2) = -\frac{1}{3}(x - 6)$

$y = -\frac{1}{3}x$

42. $m = 1$
$y - 2 = 1(x - 1)$
$y = x + 1$

43. $m = \frac{1}{2}$

$y - (-3) = \frac{1}{2}(x - 2)$

$y = \frac{1}{2}x - 4$

44. $m = -7$
$y - 0 = -7(x - 5)$
$y = -7x + 35$

45. $m = -\frac{2}{5}$

$y - 5 = -\frac{2}{5}(x - 0)$

$y = -\frac{2}{5}x + 5$

46. $m = 0$
$y - 4 = 0(x - 7)$
$y = 4$

47. $m = \frac{3-(-3)}{-1-5} = -1$
$y - 3 = -1[x - (-1)]$
$y = -x + 2$

48. $m = \frac{2-1}{4-2} = \frac{1}{2}$

$y - 1 = \frac{1}{2}(x - 2)$

$y = \frac{1}{2}x$

49. $m = \frac{-1-(-1)}{3-2} = 0$
$y - (-1) = 0(x - 2)$
$y = -1$

50. $m = \dfrac{-2-0}{1-0} = -2$

$y = -2x$

51. $\begin{cases} 4x+5y=7 \\ 2x-3y=9 \end{cases} \Rightarrow (3,-1)$

$y-(-1) = 2(x-3)$

$y+1 = 2x-6$

$y = 2x-7$

52. $\begin{cases} 4x-3y=1 \\ \dfrac{1}{2}x+y=7 \end{cases} \Rightarrow (4,5)$

$y-5 = -3(x-4)$

$y-5 = -3x+12$

$y = -3x+17$

53. Changes in x-coordinate: 1, –1, –2
Changes in y-coordinate are m times that or 2, –2, –4: new y values are 5, 1, –1

54. Change in x coordinates are 1, 2, –1.
Change in y coordinates are m times that or –3, –6, 3. New y values are –1, –4, 5.

55. The slope is $\dfrac{-1}{4}$ Changes in x coordinates are 1, 2, –1. Changes in y coordinates are m times the x coordinate changes. New y coordinates are $\dfrac{-5}{4}, \dfrac{-3}{2}, \dfrac{-3}{4}$

56. Changes in x-coordinate: 1, 2, 3
Changes in y-coordinate are m times that:
$\dfrac{1}{3}, \dfrac{2}{3}, 1$
y-coordinates:
$2+\dfrac{1}{3} = \dfrac{7}{3},\ 2+\dfrac{2}{3} = \dfrac{8}{3},\ 2+1 = 3$
$\dfrac{7}{3}; \dfrac{8}{3}; 3$

57. **a.** $x+y=1$
$y = -x+1$
(C)

b. $x-y=1$
$y = x-1$
(B)

c. $x+y=-1$
$y = -x-1$
(D)

d. $x-y=-1$
$y = x+1$
(A)

58. $m = \dfrac{4.8-3.6}{4.9-4.8} = 12;$
$y-6 = 12(x-5)$
$y = 12x-54$
$b = -54$

59. One possible equation is $y = x+1$.

60. One possible equation is $y = -x+1$.

61. One possible equation is $y = 5$.

62. One possible equation is $x = 2$.

63. One possible equation is $y = -\dfrac{2}{3}x$.

64. One possible equation is $y = \dfrac{6}{5}x$.

65. $m = \dfrac{212-32}{100-0} = \dfrac{9}{5}$

$F-32 = \dfrac{9}{5}(C-0)$

$F = \dfrac{9}{5}C+32$

66. Let x = years B.C. and y = feet.

$m = \dfrac{8-4}{2100-1500} = \dfrac{1}{150}$

$y-4 = \dfrac{1}{150}(x-1500)$

$y = \dfrac{1}{150}x-6$

$y = \dfrac{1}{150}(3000)-6 = 14\,ft$

67. Let 1995 correspond to x = 0. So in 2009, x = 14. When x = 0 , tuition is 2848. When x = 14, tuition is 6695. Using (0,2848) and (14,6695) as ordered pairs, find the slope of the line containing these points: $\frac{6695-2848}{14-0}=\frac{3847}{14}$. Since the y-intercept is 2848, the equation becomes $y=\frac{3847}{14}x+2848$. Therefore, in 2002 when x =7, the tuition should approximately be $y=\frac{3847}{14}(7)+2848=4771.50$.

68. Let 1990 correspond to x = 0. So in 2009, x = 19. When x = 0 , enrollment is 5.2 million. When x = 19, enrollment is 7.5 million. Using (0,5.2) and (19,7.5) as ordered pairs, find the slope of the line containing these points: $\frac{7.5-5.2}{19-0}=\frac{2.3}{19}=\frac{23}{190}$. Since the y-intercept is 5.2, the equation becomes $y=\frac{23}{190}x+5.2$. Therefore, the enrollment was at 6 million:

$$y=\frac{23}{190}x+5.2$$
$$6=\frac{23}{190}x+5.2$$
$$6.6=x$$

Since x is the number of years after 1990, the enrollment was 6 million around 1997.

69. Let x = number of pounds tires are under inflated. When x = 0, the miles per gallon (y) is 25. When x = 1, mpg decreases to 24.5. The equation is $y=-\frac{1}{2}x+25$. Thus, when x = 8 pounds the miles per gallon will be $y=-\frac{1}{2}(8)+25=21$ mpg.

70. The slope is $\frac{1,382,600-921,700}{10}=46090$. The equation is y = 46090x + 921,700. When x = 4 (2012), y = 46090(4) + 921,700 =1,106,060.

71. Let 1991 correspond to x = 0 and 2009 correspond to x = 18. Then, the two ordered pairs are on the line: (0, 249,165) and (18,347,985). The slope of the line is $\frac{347,985-249,165}{18-0}=5490$ The equation of the line is therefore $y=5490x+249,165$. In the year 2014, x = 23, so the number of Bachelor's degrees awarded can be estimated as $y=5490(23)+249,165=375,435$.

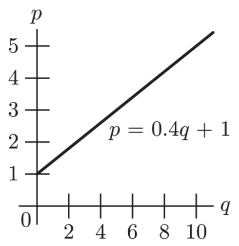
72. The slope is $\frac{4929-4818}{9}=\frac{37}{3}$. The equation is $y=\frac{37}{3}x+4818$. Find x when y = 5100. We have $5100=\frac{37}{3}x+4818$. Solving for x gives x about 22.9 years or in the year 2024.

73. Let 2010 correspond to x = 0 and 2012 correspond to x = 2. Then, the two ordered pairs are on the line: (0, 2.5) and (2,3.5). The slope of the line is $\frac{3.5-2.5}{2-0}=.5$. The equation of the line is therefore $y=.5x+2.5$. In the year 2011, x = 1, so the cost of a 30-second advertising slot (in millions) can be estimated as $y=.5(1)+2.5=\$3$ million.

74. The slope is $\frac{500-3000}{4-0}=-625$. The equation is $y=-625x+3000$.

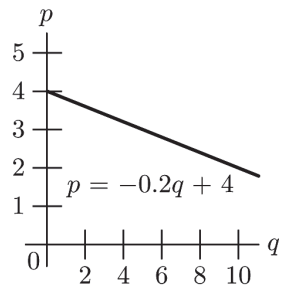
75. The slope is $\frac{3.4-3}{6-5}=.4$

$$p-p_1=m(q-q_1)$$
$$p-3=.4(q-5)$$
$$p-3=.4q-2$$
$$p=.4q+1$$



76. The slope is $\frac{3.1-3}{4.5-5}=\frac{.1}{-.5}=-.2$

$$p-p_1=m(q-q_1)$$
$$p-3=-.2(q-5)$$
$$p-3=-.2q+1$$
$$p=-.2q+4$$



77. $m=\frac{9-5}{4-2}=2$

$$y-5\le 2(x-2)$$
$$y\le 2x+1$$

78. $y\ge 4x+3$

79. $m_1=\frac{8-5}{2-(-2)}=\frac{3}{4}$

$$y-8=\frac{3}{4}(x-2)$$
$$y=\frac{3}{4}x+\frac{13}{2}$$
$$m_2=\frac{1-8}{5-2}=-\frac{7}{3}$$
$$y-1=-\frac{7}{3}(x-5)$$
$$y=-\frac{7}{3}x+\frac{38}{3}$$
$$m_3=\frac{1-5}{5-(-2)}=-\frac{4}{7}$$
$$y-1=-\frac{4}{7}(x-5)$$
$$y=-\frac{4}{7}x+\frac{27}{7}$$

$$\begin{cases} y\le \frac{3}{4}x+\frac{13}{2} \\ y\le -\frac{7}{3}x+\frac{38}{3} \\ y\ge -\frac{4}{7}x+\frac{27}{7} \end{cases}$$

80. $m_1=\frac{3-4}{2-0}=-\frac{1}{2}$

$$y=-\frac{1}{2}x+4$$
$$m_2=\frac{1-3}{4-2}=-1$$
$$y-1=-(x-4)$$
$$y=-x+5$$
$$m_3=\frac{1-0}{4-3}=1$$
$$y=x-3$$

$$\begin{cases} y\le -\frac{1}{2}x+4 \\ y\le -x+5 \\ y\ge x-3 \\ x\ge 0,\ y\ge 0 \end{cases}$$

81. $m_1=\frac{4-3}{2-1}=1$

$$m_2=\frac{-1-4}{3-2}=-5$$
$$m_1\ne m_2$$

82. Set two slopes equal:

$$\frac{7-5}{2-1}=\frac{k-7}{3-2}$$
$$2=k-7$$
$$k=9$$

83. Set slopes equal:

$$\frac{-3.1-1}{2-a}=\frac{2.4-0}{3.8-(-1)}$$

$$\frac{-4.1}{2-a}=\frac{1}{2}$$

$$-8.2=2-a$$

$$a=10.2$$

84. Make slopes negative inverses of each other:

$$\frac{-3.1-1}{2-a}=-\frac{1}{\frac{2.4-0}{3.8-(-1)}}$$

$$\frac{-4.1}{2-a}=-2$$

$$4.1=4-2a$$

$$a=-.05$$

85. Solve $mx+b=m'x+b'$

$$(m-m')x=b'-b$$

$$x=\frac{b'-b}{m-m'},$$

which is defined if and only if $m\neq m'$.

86. $l_1: y=m_1x$

$l_2: y=m_2x$

So the vertical segment lies on $x = 1$.

Then

$1^2+m_1^2=a^2$

$1^2+(-m_2)^2=b^2$

Add equations and rearrange:

$a^2+b^2-(m_1^2+m_2^2)=2$

l_1 and l_2 are perpendicular if and only if

$a^2+b^2=(m_1-m_2)^2=m_1^2+m_2^2-2m_1m_2$

or $a^2+b^2-(m_1^2+m_2^2)=-2m_1m_2$

Substitute: $2=-2m_1m_2$

Therefore, the product of the slopes are –1.

87. Let x = Centigrade temperature

y = Fahrenheit temperature

$$m=\frac{212-32}{100-0}=1.8$$

$$y=1.8x+32$$

$$y=1.8(30)+32=86°\text{F}$$

Answer (b) is correct.

88. Let x = weight

y = cost

$$m=\frac{38-5}{60-0}=\frac{11}{20}$$

$$y=\frac{11}{20}x+5$$

$$y=\frac{11}{20}(20)+5=\$16$$

The answer is (c).

89. Let x = number of T-shirts

profit = revenue – cost

$$65,000=12.50x-(8x+25,000)$$

$$90,000=4.50x$$

$$x=20,000$$

So 20,000 T-shirts must be produced and sold.

Answer (d) is correct.

90. Let x = number of units

profit = revenue – cost

$$2,000,000=130x-(100x+1,000,000)$$

$$3,000,000=30x$$

$$x=100,000 \text{ units}$$

Answer (e) is correct.

91. $q=800-4(150)$

$=200$ bikes

revenue = 150(200) = \$30,000

Answer (d) is correct.

92. $n=2200-25(8)$

$=2000$ cameras

revenue = 8(2000) = \$16,000

Answer (c) is correct.

93. Let x = variable costs

For 2008: profit = revenue – cost

$$400,000=100(50,000)-(50,000x+600,000)$$

$$50,000x=4,000,000$$

$$x=\$80 \text{ per unit}$$

For 2009:

Let y = 2009 price

profit = revenue – cost

$$400,000=50,000y-$$

$$[80(50,000)+600,000+200,000]$$

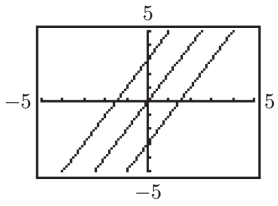
$$5,200,000=50,000y$$

$$y=\$104$$

Answer (d) is correct.

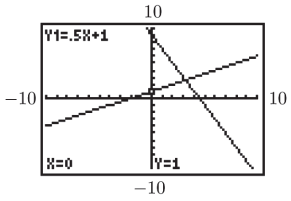
94. Let x = variable costs
For 2008: profit = revenue – costs
$$300,000 = 100(50,000) - (50,000x + 800,000)$$
$$50,000x = 3,900,000$$
$$x = \$78 \text{ per unit}$$
For 2009:
Let y = 2009 price
profit = revenue – cost
$$300,000 = 50,000y - [78(50,000) + 800,000 + 200,000]$$
$$5,200,000 = 50,000y$$
$$y = \$104$$
Answer (d) is correct.

95

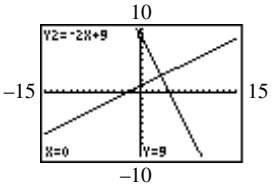


From left to right the lines are $y = 2x + 3$, $y = 2x$, and $y = 2x - 3$.
The lines are distinguished by their y-intercepts, which appear as b in the form $y = mx + b$.

96.

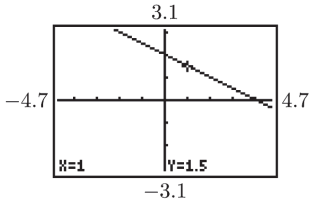


No, do not appear perpendicular



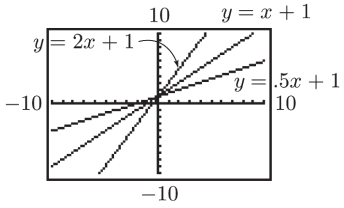
Do appear perpendicular

97.



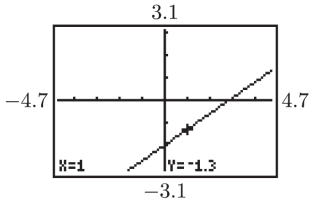
Since the slope equals $-\frac{1}{2}$, moving 2 units to the right requires moving $2 \cdot \left(-\frac{1}{2}\right) = -1$ unit up, or 1 unit down.

98.



The steeper the line, the greater the slope m in $y = mx + b$ form.

99.



Since the slope equals 0.7, moving 2 units to the right requires moving $2 \cdot .7 = 1.4$ units up.

Exercises 1.5

1.

Data Point	Point on Line	Vertical Distance
(1, 3)	(1, 4)	1
(2, 6)	(2, 7)	1
(3, 11)	(3, 10)	1
(4, 12)	(4, 13)	1

$1^2 + 1^2 + 1^2 + 1^2 = 4$

2.

Data Point	Point on Line	Vertical Distance
(1, 11)	(1, 10)	1
(2, 7)	(2, 8)	1
(3, 5)	(3, 6)	1
(4, 5)	(4, 4)	1

$E = 1^2 + 1^2 + 1^2 + 1^2 = 4$

3. $E_1^2 = [1.1(1) + 3 - 3]^2 = 1.21$

$E_2^2 = [1.1(2) + 3 - 6]^2 = .64$

$E_3^2 = [1.1(3) + 3 - 8]^2 = 2.89$

$E_4^2 = [1.1(4) + 3 - 6]^2 = 1.96$

$E = 1.21 + .64 + 2.89 + 1.96 = 6.70$

4. $E_1^2 = [-1.3(1) + 8.3 - 8]^2 = 1.00$

$E_2^2 = [-1.3(2) + 8.3 - 5]^2 = .49$

$E_3^2 = [-1.3(3) + 8.3 - 3]^2 = 1.96$

$E_4^2 = [-1.3(4) + 8.3 - 4]^2 = .81$

$E_5^2 = [-1.3(5) + 8.3 - 2]^2 = .04$

$E = 1.00 + .49 + 1.96 + .81 + .04 = 4.30$

5.

x	y	xy	x^2
1	7	7	1
2	6	12	4
3	4	12	9
4	3	12	16
$\sum x = 10$	$\sum y = 20$	$\sum xy = 43$	$\sum x^2 = 30$

$$m = \frac{4 \cdot 43 - 10 \cdot 20}{4 \cdot 30 - 10^2} = -1.4$$

$$b = \frac{20 - (-1.4)(10)}{4} = 8.5$$

6.

x	y	xy	x^2
1	2	2	1
2	4	8	4
3	7	21	9
4	9	36	16
5	12	60	25
$\sum x = 15$	$\sum y = 34$	$\sum xy = 127$	$\sum x^2 = 55$

$$m = \frac{5 \cdot 127 - 15 \cdot 34}{5 \cdot 55 - 15^2} = 2.5$$

$$b = \frac{34 - (2.5)(15)}{5} = -.7$$

7. $\sum x = 6, \sum y = 18, \sum xy = 45, \sum x^2 = 14$

$$m = \frac{3 \cdot 45 - 6 \cdot 18}{3 \cdot 14 - 6^2} = 4.5$$

$$b = \frac{18 - (4.5)(6)}{3} = -3$$

$$y = 4.5x - 3$$

8. $\sum x = 7, \sum y = 15, \sum xy = 28, \sum x^2 = 21$

$$m = \frac{3 \cdot 28 - 7 \cdot 15}{3 \cdot 21 - 7^2} = -1.5$$

$$b = \frac{15 - (-1.5)(7)}{3} = 8.5$$

$$y = -1.5x + 8.5$$

9. $\sum x = 10, \sum y = 26, \sum xy = 55,$

$\sum x^2 = 30$

$$m = \frac{4 \cdot 55 - 10 \cdot 26}{4 \cdot 30 - 10^2} = -2$$

$$b = \frac{26 - (-2)(10)}{4} = 11.5$$

$$y = -2x + 11.5$$

10. $\sum x = 10, \sum y = 28, \sum xy = 77, \sum x^2 = 30$

$$m = \frac{4 \cdot 77 - 10 \cdot 28}{4 \cdot 30 - 10^2} = 1.4$$

$$b = \frac{28 - (1.4)(10)}{4} = 3.5$$

$$y = 1.4x + 3.5$$

11. **a.** $\sum x = 12, \sum y = 7, \sum xy = 41,$

$\sum x^2 = 74$

$$m = \frac{2 \cdot 41 - 12 \cdot 7}{2 \cdot 74 - 12^2} = -.5$$

$$b = \frac{7 - (-.5)(12)}{2} = 6.5$$

$$y = -.5x + 6.5$$

b. $m = \frac{4-3}{5-7} = -\frac{1}{2} = -.5$

$$y - 3 = -.5(x - 7)$$

$$y = -.5x + 6.5$$

c. The least–squares error for the line in (b) is E=0.

12. The least–squares error for the line E=0.

13. **a.** $\sum x = 7, \sum y = 20, \sum xy = 90,$

$\sum x^2 = 37$

$$m = \frac{2 \cdot 90 - 7 \cdot 20}{2 \cdot 37 - 7^2} = 1.6$$

$$b = \frac{20 - (1.6)(7)}{2} = 4.4$$

$$y = 1.6x + 4.4$$

b. $E = [1.6(4) + 4.4 - 5]^2 = 33.64$

14. **a.** $\sum x = 10, \sum y = 19, \sum xy = 104,$

$\sum x^2 = 52$

$$m = \frac{2 \cdot 104 - 10 \cdot 19}{2 \cdot 52 - 10^2} = 4.5$$

$$b = \frac{19 - (4.5)(10)}{2} = -13$$

$$y = 4.5x - 13$$

b. $E = [4.5(1) - 13 - 6]^2 = 210.25$

15. **a.** Let x represent city and y represent highway, then $\sum x = 179, \sum y = 167, \sum xy = 7537,$

$\sum x^2 = 8067$

$$m = \frac{4 \cdot 7537 - 179 \cdot 167}{4 \cdot 8067 - 179^2} = 1.12335$$

$$b = \frac{167 - (1.12335)(179)}{4} = -8.51982$$

$$y = 1.12335x - 8.51982$$

b. $y = 1.12335(47) - 8.51982$

$y = 44.28$ mpg

c. $47 = 1.12335x - 8.51982$

$x = 49.42$ mpg

16. **a.** Let x represent stores and y represent sales, then

$\sum x = 18.142, \sum y = 12,046, \sum xy = 66475.541,$

$\sum x^2 = 97.244363$

$$m = \frac{4 \cdot 66475.541 - 18.142 \cdot 12046}{4 \cdot 97.244363 - 18.142^2} = 790.638$$

$$b = \frac{12046 - (790.638)(18.142)}{4} = -574.437$$

$$y = 790.638x - 574.437$$

b. $y = 790.638(4) - 574.437$

$y = 2588.115$ million

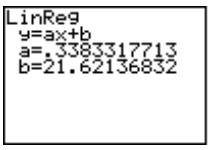
$y = \$2,588,115,000$

c. $1500 = 790.638x - 574.437$

$x = 2.624$ thousand

$x = 2624$

17. a.



$y = .338x + 21.6$

b. $.338(1100) + 21.6 = 393.4$
About 393 deaths per million males

18. a. $y = 2648.1x - 2436.8$

b. $2648.1(2.04) - 2436.8 = 2965.324$
About 2965 average miles per automobile

c. $11{,}868 = 2648.1x - 2436.8$

$x \approx 5.40$
About \$5.40

19. a. Let x be the number of years after 1985, then $y = 0.423x + 19.2$

b. $.423(23) + 19.2 = 28.929$
About 28.9%

c. $32 = .423x + 19.2$

$x \approx 30.26$
The year 2015

20. a. Let x be the number of years after 2000, then $y = .24x + 12$

b. $.24(5) + 12 = 13.2$
13.2 million

c. $17 = 0.24x + 12$

$x = 20.83$
The year 2021

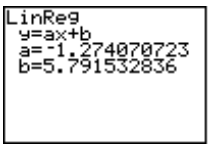
21. a. $y = .1475x + 73.78$

b. $.1475(30) + 73.78 = 78.205$
About 78.2 years

c. $.1475(50) + 73.78 = 81.155$
About 81.2 years

d. $.1475(90) + 73.78 = 87.055$
About 87.1 years (This is an example of a fit that is not capable of extrapolating beyond the given data)

22. a.



$y = -1.274x + 5.792$

b. The higher the independence, the lower the inflation rate.

c. $-1.274(.6) + 5.792 = 5.0276$
About 5.0%

d. $6.8 = -1.274x + 5.792$

$x \approx -.791$
About $-.8$

23. a. Let x be the number of years after 2000, then $y = .028x + .846$

b. $.028(9) + .846 \approx 1.098$
About \$1.10

c. $1.35 = .028x + .846$

$x = 18$
The year 2018

24. a. $y = 1.60x + 321.6$

b. The year 2000 is 32 years after the base year of 1968, therefore:
$1.60(32) + 321.6 = 372.8$
372.8; It is close to the actual value.

c. $401 = 1.60x + 321.6$

$x \approx 49.625$
The year is 50 years after 1968 or 2018.

Chapter 1 Fundamental Concept Check

1. To determine the x-coordinate (y-coordinate), draw a straight line through the point perpendicular through the x-axis (y-axis) and read the number on the axis.

2. The graph is the collection of points in the plane whose coordinates satisfy the equation.

3. $ax + by = c,$ where both a and b are not 0.

4. $y = mx + b$ or $x = a.$

5. The y-intercept is the point at which the graph of the line crosses the y-axis. To find the y-intercept, set $x = 0$ and solve for y. Then the y-intercept is the point (0, solution for y).

6. The x-intercept is the point at which the graph of the line crosses the x-axis. To find the x-intercept, set $y = 0$ and solve for x. Then the x-intercept is the point (solution for x, 0).

7. See the tinted box on page 5.

8. If $a < b$ then $a + c < b + c$, $a - c < b - c$, $ac < bc$ (when c is positive), and $ac > bc$ (when c is negative).

9. General forms: $cx + dy \le e$ or $cx + dy \ge e$ where c and d are not both 0. Standard forms: $y \le mx + b$, $y \ge mx + b$, $x \le a$, and $x \ge a$.

10. Put the inequality into standard form, draw the related linear equation, and cross out the side that does not satisfy the inequality.

11. The collection of points that satisfy every inequality in the system.

12. First put the two linear equations into standard form. If both equations have the form $y =$ *something*, equate the two expressions for y, solve for x, substitute the value for x into one of the equations, and solve for y. Otherwise, substitute the value of x into the equation containing y and solve for y.

13. The slope of the line $y = mx + b$ is the number m. It is a measure of the steepness of the line.

14. Plot the given point, move one unit to the right the $|m|$ units in the y-direction (up if m is positive and down if m is negative), plot the second point, and draw a line through the two points.

15. $y - y_1 = m(x - x_1)$, where (x_1, y_1) is a point on the line and m is the slope of the line.

16. First calculate the slope $m = \dfrac{y_2 - y_1}{x_2 - x_1}$. Then, use m, either of the two points, and the point-slope formula to write the equation for the line.

17. One slope is the negative reciprocal of the other.

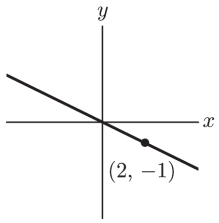
18. They are the same.

19. The straight line that gives the best fit to a collection of points in the sense that the sum of the squares of the vertical distances from the points to the line is as small as possible.

Chapter 1 Review Exercises

1. $x = 0$

2.



3. $\begin{cases} x - 5y = 6 \\ 3x = 6 \end{cases}$

$\begin{cases} x = 5y + 6 \\ x = 2 \end{cases}$

$5y + 6 = 2$

$y = -\dfrac{4}{5}$

$\left(2, -\dfrac{4}{5}\right)$

4. $3x - 4y = 8$

$y = \dfrac{3}{4}x - 2$

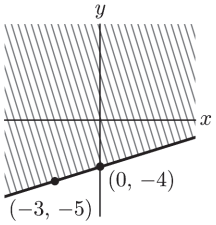
$m = \dfrac{3}{4}$

5. $m = \dfrac{0 - 5}{10 - 0} = -\dfrac{1}{2}$, $b = 5$

$y = -\dfrac{1}{2}x + 5$

6. $x - 3y \ge 12$

$y \le \dfrac{1}{3}x - 4$



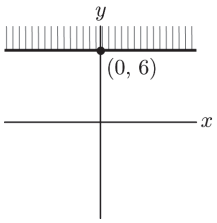
7. $3(1) + 4(2) \geq 11$
$3 + 8 \geq 11$
$11 \geq 11$
Yes

8. $\begin{cases} 2x - y = 1 \\ x + 2y = 13 \end{cases}$
$\begin{cases} y = 2x - 1 \\ y = -\frac{1}{2}x + \frac{13}{2} \end{cases}$
$2x - 1 = -\frac{1}{2}x + \frac{13}{2}$
$\frac{5}{2}x = \frac{15}{2}$
$x = 3$
$y = 2(3) - 1 = 5$
(3, 5)

9. $2x - 10y = 7$
$y = \frac{1}{5}x - \frac{7}{10}$
$m = \frac{1}{5}$
$y - 16 = \frac{1}{5}(x - 15)$
$y = \frac{1}{5}x + 13$

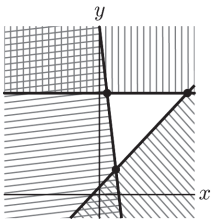
10. $y = 3(1) + 7 = 10$

11. (5, 0)

12.


13. $\begin{cases} 3x - 2y = 1 \\ 2x + y = 24 \end{cases}$
$\begin{cases} y = \frac{3}{2}x - \frac{1}{2} \\ y = -2x + 24 \end{cases}$
$\frac{3}{2}x - \frac{1}{2} = -2x + 24$
$\frac{7}{2}x = \frac{49}{2}$
$x = 7$
$y = -2(7) + 24 = 10$
(7, 10)

14. $\begin{cases} 2y + 7x \geq 28 \\ 2y - x \geq 0 \\ y \leq 8 \end{cases}$
$\begin{cases} y \geq -\frac{7}{2}x + 14 \\ y \geq \frac{1}{2}x \\ y \leq 8 \end{cases}$



15. $y - 9 = \frac{1}{2}(x - 4)$
$y = \frac{1}{2}x + 7$
$b = 7$
(0, 7)

16. The rate is \$35 per hour plus a flat fee of \$20.

17. $m_1 = \frac{0 - 2}{2 - 1} = -2$
$m_2 = \frac{1 - 0}{3 - 2} = 1$
$m_1 \neq m_2$
No

18. $m = \frac{-2 - 0}{0 - 3} = \frac{2}{3}$, $b = -2$
$y = \frac{2}{3}x - 2$

19. $x+7y=30$
$-2y+7y=30$
$5y=30$
$y=6$
Answer (d) is correct.

20. $y \le \frac{2}{3}x+\frac{3}{2}$

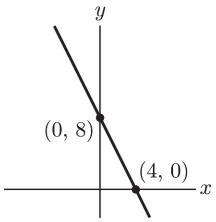
21. $m=\frac{8.6-(-1)}{6-2}=2.4$
$y+1 \ge 2.4(x-2)$
$y \ge 2.4x-5.8$

22. $\begin{cases}1.2x+2.4y=.6\\4.8y-1.6x=2.4\end{cases}$
$\begin{cases}y=-.5x+.25\\y=\frac{1}{3}x+.5\end{cases}$
$-.5x+.25=\frac{1}{3}x+.5$
$-\frac{5}{6}x=.25$
$x=-.3$
$y=\frac{1}{3}(-.3)+.5=.4$

23. $\begin{cases}y=-x+1\\y=2x+3\end{cases}$
$-x+1=2x+3$
$-3x=2$
$x=-\frac{2}{3}$
$y=-\left(-\frac{2}{3}\right)+1=\frac{5}{3}$
$\left(-\frac{2}{3},\frac{5}{3}\right)$
$m=\frac{\frac{5}{3}-1}{-\frac{2}{3}-1}=-\frac{2}{5}$
$y-1=-\frac{2}{5}(x-1)$
$y=-\frac{2}{5}x+\frac{7}{5}$

24. $2x+3(x-2) \ge 0$
$5x \ge 6$
$x \ge \frac{6}{5}$

25. $x+\frac{1}{2}y=4$
$y=-2x+8$
$m=-2$
y-intercept: (0, 8)
$0=-2x+8$
$x=4$
x-intercept: (4, 0)



26. $\begin{cases}5x+2y=0\\x+y=1\end{cases}$
$\begin{cases}y=-\frac{5}{2}x\\y=-x+1\end{cases}$
$-\frac{5}{2}x=-x+1$
$-\frac{3}{2}x=1$
$x=-\frac{2}{3}$
$y=-\left(-\frac{2}{3}\right)+1=\frac{5}{3}$
Substitute $x=-\frac{2}{3}$ and $y=\frac{5}{3}$ in
$2x-3y=1$
$2\left(-\frac{2}{3}\right)-3\left(\frac{5}{3}\right)=1$
$-\frac{19}{3}=1$
No

27. $\begin{cases} 2x-3y=1 \\ 3x+2y=4 \end{cases}$

$\begin{cases} y=\frac{2}{3}x-\frac{1}{3} \\ y=-\frac{3}{2}x+2 \end{cases}$

$m_1=-\frac{1}{m_2}$

28. **a.** $x+y\geq 1$

$y\geq -x+1$

(C)

b. $x+y\leq 1$

$y\leq -x+1$

(A)

c. $x-y\leq 1$

$y\geq x-1$

(B)

d. $y-x\leq -1$

$y\leq x-1$

(D)

29. **a.** $4x+y=17$

$y=-4x+17$

L_3

b. $y=x+2$

L_1

c. $2x+3y=11$

$y=-\frac{2}{3}x+\frac{11}{3}$

L_2

30. $m_1=\frac{\frac{3}{2}-5}{4-0}=-\frac{7}{8}$, $b_1=5$

$y=-\frac{7}{8}x+5$

$m_2=-\frac{1}{m_1}=\frac{8}{7}$

$y-\frac{3}{2}=\frac{8}{7}(x-4)$

$y=\frac{8}{7}x-\frac{43}{14}$

$\begin{cases} y\leq -\frac{7}{8}x+5 \\ y\geq \frac{8}{7}x-\frac{43}{14} \\ x\geq 0,\ y\geq 0 \end{cases}$

$0=\frac{8}{7}x-\frac{43}{14}$

$x=\frac{43}{16}$

$\left(\frac{43}{16}, 0\right)$

31. Supply curve is $p = .005q + .5$

Demand curve is $p = -.01q + 5$

$\begin{cases} p=.005q+.5 \\ p=-.01q+5 \end{cases}$

$.005q+.5=-.01q+5$

$.015q=4.5$

$q=300$ units

$p = .005(300) + .5 = \$2$

32. $\begin{cases} x\geq 0 \\ y\geq 0 \end{cases}$

(0, 0)

$\begin{cases} y\geq 0 \\ 5x+y\leq 50 \end{cases}$

$\begin{cases} y\geq 0 \\ y\leq -5x+50 \end{cases}$

$0 = -5x + 50$

$x = 10$

(10, 0)

$\begin{cases} 5x+y\leq 50 \\ 2x+3y\leq 33 \end{cases}$

$\begin{cases} y\leq -5x+50 \\ y\leq -\frac{2}{3}x+11 \end{cases}$

$-5x+50=-\frac{2}{3}x+11$

$-\frac{13}{3}x=-39$

$x=9$

$y = -5(9) + 50 = 5$

(9, 5)

$$\begin{cases} 2x+3y \le 33 \\ x-2y \ge -8 \end{cases}$$

$$\begin{cases} y \le -\frac{2}{3}x+11 \\ y \le \frac{1}{2}x+4 \end{cases}$$

$$-\frac{2}{3}x+11=\frac{1}{2}x+4$$

$$-\frac{7}{6}x=-7$$

$$x=6$$

$$x=\frac{1}{2}(6)+4=7$$

(6, 7)

$$\begin{cases} x-2y \ge -8 \\ x \ge 0 \end{cases}$$

$$\begin{cases} x \ge 2y-8 \\ x \ge 0 \end{cases}$$

$$2y-8=0$$

$$y=4$$

(0, 4)

33. a. In 2000, 8.9% of college freshmen intended to obtain a medical degree.

b. $2011-2000=11$

$y=0.1(11)+8.9$

$y=10$

10% of college freshmen in 2011 intended to obtain a medical degree. It is close to the actual value.

c. $9.3=.1x+8.9$

$x=4$

$2000+4=2004$

In 2004, the percent of college freshmen that intended to obtain a medical degree was 9.3.

34. a. $m=10$

$y-4000=10(x-1000)$

$y=10x-6000$

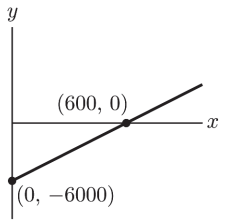
b. $0 = 10x - 6000$

$x = 600$

x-intercept: (600, 0)

y-intercept: (0, –6000)

c.



35. a. A: $y = .1x + 50$

B: $y = .2x + 40$

b. A: $.1(80) + 50 = 58$

B: $.2(80) + 40 = 56$

Company B

c. A: $.1(160) + 50 = 66$

B: $.2(160) + 40 = 72$

Company A

d. $.1x + 50 = .2x + 40$

$-.1x = -10$

$x = 100$ miles

36. a. $m=\frac{1.44-.93}{11-0}=.046$

$y-.93=.046(x-0)$

$y=.046x+.93$

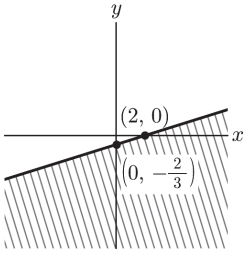
b. $1.27=.046x+.93$

$x \approx 7.39$

The year 2000 + 7 = 2007

37. $x \le 3y + 2$

$y \ge \frac{1}{3}x-\frac{2}{3}$



38. $.03x + 200 = .05x + 100$

$-.02x = -100$

$x = \$5000$

39. $m_1 = \dfrac{5-0}{0-(-4)} = \dfrac{5}{4}$, $b_1 = 5$

$y = \dfrac{5}{4}x + 5$

$m_2 = \dfrac{0-2}{5-0} = -\dfrac{2}{5}$, $b_2 = 2$

$y = -\dfrac{2}{5}x + 2$

$m_3 = \dfrac{0-(-3)}{5-0} = \dfrac{3}{5}$, $b_3 = -3$

$y = \dfrac{3}{5}x - 3$

$m_4 = \dfrac{-5-0}{0-(-2)} = -\dfrac{5}{2}$, $b_4 = -5$

$y = -\dfrac{5}{2}x - 5$

$$\begin{cases} y \le \dfrac{5}{4}x + 5 \\ y \le -\dfrac{2}{5}x + 2 \\ y \ge \dfrac{3}{5}x - 3 \\ y \ge -\dfrac{5}{2} - 5 \end{cases}$$

40. $m_1 = \dfrac{2-0}{0-3} = -\dfrac{2}{3}$, $b_1 = 2$

$y = -\dfrac{2}{3}x + 2$

The other lines are $x = -2$, $x = 4$, and $y = -3$.

$$\begin{cases} y \le -\dfrac{2}{3}x + 2 \\ x \ge -2 \\ x \le 4 \\ y \ge -3 \end{cases}$$

41. (0, 483,600) ; in 2018: (10, 647,500)

$m = \dfrac{647,500 - 483,600}{10 - 0} = 16390$

$y - 483,600 = 16390(x - 0)$

$y = 16,390x + 483,600$

For the year 2014, x=6:

$y = 16390(6) + 483,600 = 581,940.$

42. Slope of line is –282.77. Equation of line is: y = –282.77x + 105,384. In 2014, x = 18 so y = 100,294.

43. Let x = 0 correspond to year 2000. Then y = 20.4. When x = 10, y = 17.0. The rate of change (slope) = (17.0 – 20.4)/(10 – 0) = –.34. The equation of the line that predicts the percentage of market is y = –.34x + 20.4. When x = 8, y = 17.7%.

44. **a.** $y = .936x + 10.8$

b. .936(77.5) +10.8 = 83.34
About 83.3 years

c. $84.5 = .936x + 10.8$

$x \approx 78.74$

About 78.7 years

45. **a.** $y = .2075x + 2.43$

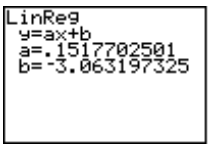
b. .2075(14) +2.43 =5.34
About 5.3%

c. $5.75 = .2075x + 2.43$

$x = 16$

16 years after 1999 or 2015

46. **a.**



$y = .152x - 3.063$

b. .152(160) – 3.063 = 21.257
About 21 deaths per 100,000

c. 22 = .152x – 3.063

$x \approx 164.888$

About 165 grams

47. Up; the value of b is the y-intercept

48. Counter - Clockwise

49. When the line passes through the origin.

50. A line with undefined sloe is a vertical line and a line with zero slope is a horizontal line.

51. **a.** No; A line that is parallel to the x axis and is not the *x* axis will not have an x intercept.

b. No; A line that is parallel to the y axis and is not the *y* axis will not have a y intercept

52. **Answers will vary.**

Chapter 1 Project

1. $p = -.4q + 400$

2. $p = -.4(350) + 400 = \$260$
Revenue = $260(350{,}000) = \$91{,}000{,}000$

3. $300 = -.4q + 400$
$q = 250$ thousand cameras
Revenue = $300(250{,}000) = \$75{,}000{,}000$

4. $1000q(-.4q + 400) = -400q^2 + 400{,}000q$

5. Cost = $100{,}000q + 8{,}000{,}000$

6. On your graphing calculator, set the window values to: $x:[0,1000]$ and $y:[0,100,000,000]$ and graph both equations. The graph intersects at $x \approx 27.69$, $y \approx 10{,}768{,}890$, and $x \approx 722.31$, $y \approx 80{,}231{,}110$.

7. The break-even point is $q \approx 27.69$. That is, when 27,690 cameras are sold.

8. The company will make a profit when $27.69 < q < 722.31$.