1. 7.5 cups

2. a. 15
   b. 6
   c. $19.47

3. About 66 or 67

4. a. 5
   b. $0.1116 per mile $\approx$ $0.112 per mile $\approx$ 11.2 cents per mile

5. a. 20
   b. $\frac{5}{6}$

6. Max's

7. Crystal's

8. a. I
   b. II

9. a. II
   b. I

10. $l = \frac{p}{2} - w$ $w = \frac{p}{2} - l$

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

12. $t = \frac{3}{2}(v - m)$ $m = v - \frac{2}{3}t$

13. Circle the equations that are mathematically equivalent to $P = 2l + 2w$.

$w = \frac{P - 2l}{2}$ $l = \frac{P}{2} - w$ $w = \frac{P}{2} - l$

$P = 2(l + w)$ $\frac{P}{2} = l + w$ $l = \frac{P - 2w}{2}$

14. Circle the equations that are mathematically equivalent to $y = \frac{1}{2}x + r$.

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

$2y = x + 2r$ $x = 2(y - r)$ $r = 2y - x$

15. Circle the equations that are mathematically equivalent to $m = v - \frac{2}{3}t$.

$t = \frac{2}{3}(v - m)$ $t = \frac{3}{2}v - m$ $v = \frac{2}{3}t + m$

$t = \frac{3}{2}(v - m)$ $t = \frac{2}{3}v - m$ $t = \frac{3}{2}v - \frac{3}{2}m$

16. $x = 5$

17. $x = 8$

18. $x = \frac{5}{8}$

19. $x = -3$

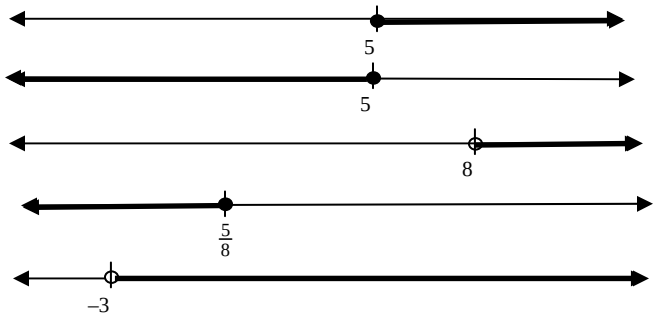
20. $x \geq 5$

21. $x \leq 5$

22. $x > 8$

23. $x \leq \frac{5}{8}$

24. $x > -3$



25. a. $15 + .75x < 18$

b. $x < 4$

c. Paolo's large pizza with 1, 2, or 3 toppings is less expensive than Pete's large pizza with any number of toppings.

26. a. $1600x > 3000 + 1250x$

b. $x > 8.571$

c. It would take Victor about 8 ½ weeks to earn more at Ideal Imaging.

27. D, there are an infinite number of solutions.

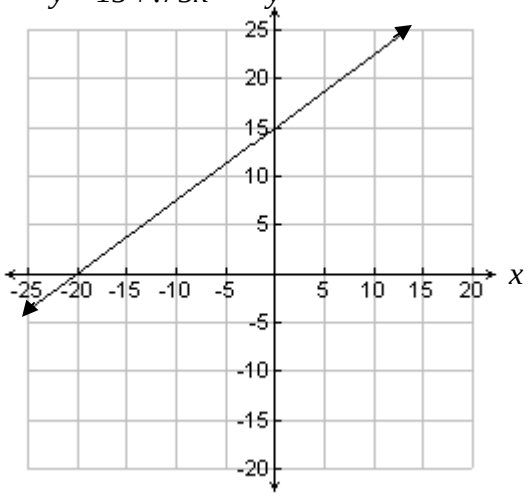
28. A line. The solutions comprise the line. That is, every coordinate pair along the line is a solution.

29. See graphs on next page.

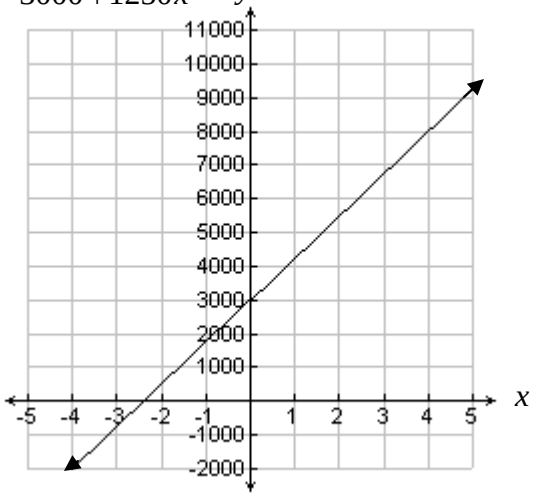
30. line 2

29.

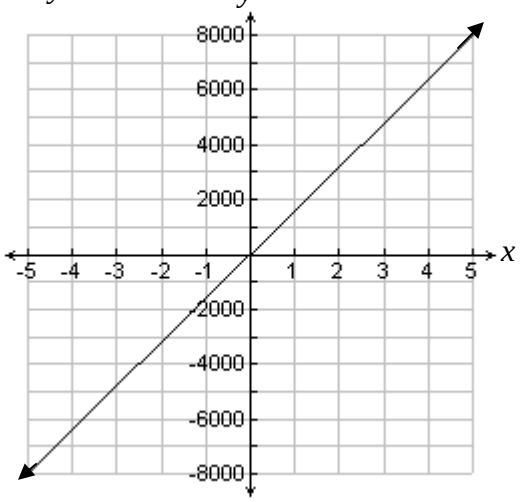
$y = 15 + .75x$



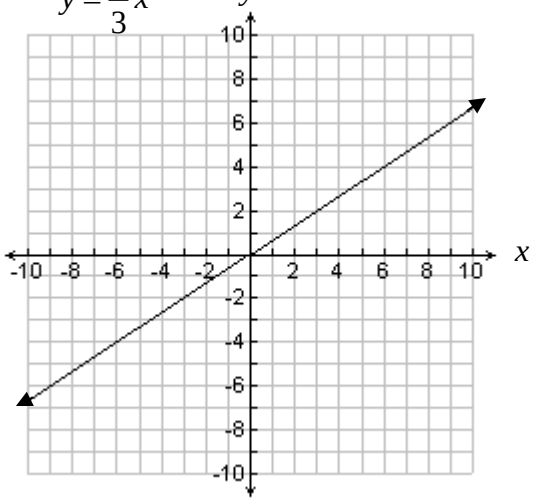
$y = 3000 + 1250x$



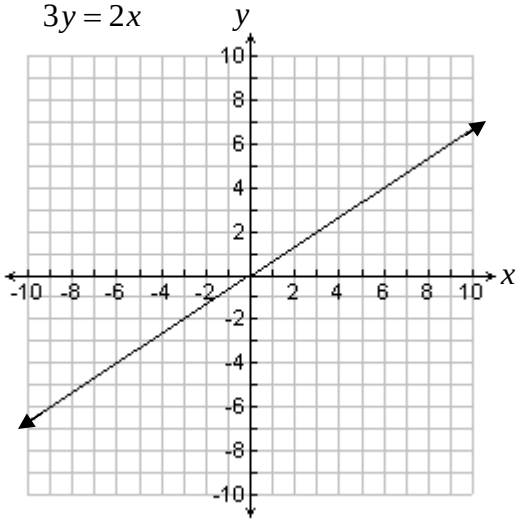
$y = 1600x$



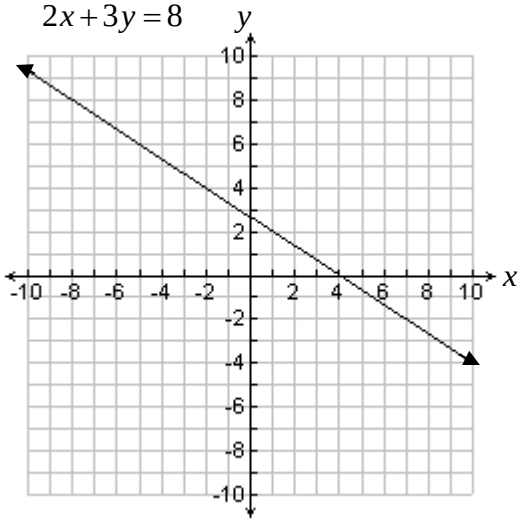
$y = \frac{2}{3}x$



$3y = 2x$



$2x + 3y = 8$



31. **Context:**

Marina is driving on a highway.

y – intercept. → At noon, she was already 80 miles from home.

Slope = Rate
65 miles per hour

Between noon and 5 P.M., she traveled at a constant rate of 65 miles per hour.

Model Marina's distance from home as a function of time since noon.

Equation:

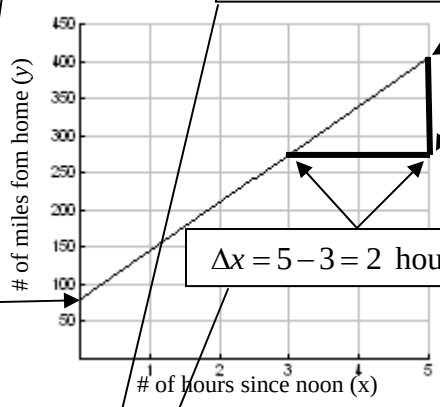
$y = 80 + 65x$

Slope = Rate
65 miles per hour.
Note that as
x increases by 1 hour,
y increases by 65 miles.
Keeping the constant rate of change,
as x increases by 2 hours,
y increases by 130 miles
and so on.

y – intercept
Note that when
$x = 0$ hours since noon,
$y = 80$ miles from home.

Graph:

$\Delta y = 405 - 275 = 130$ miles



$\Delta x = 5 - 3 = 2$ hours

y – intercept

$$\frac{\Delta y}{\Delta x} = \frac{130 miles}{2 hours} = \frac{65 miles}{1 hour}$$

Table:

# of hours since noon	# of miles from home
0	80
1	145
2	210
3	275
4	340
5	405

$\Delta x = 5 - 3 = 2$ hours

$\Delta y = 405 - 275 = 130$ miles

$$\frac{\Delta y}{\Delta x} = \frac{130 miles}{2 hours} = \frac{65 miles}{1 hour}$$

<u>The slope is the rate of change.</u>

The rate of change is the ratio of the change in y to the change in x.
In a linear function,
the ratio of the change in y to the change in x is constant.
The slope between *any* two points *anywhere* on the line or in the table is the same $\frac{\Delta y}{\Delta x}$.

In this case $\frac{65 miles}{1 hour}$.

32. **Context:**

y – intercept.

A 500 gallon underground water storage tank has a leak.

The tank is full and then water leaves the tank At a constant rate of 5 gallons every 6 hours.

Slope = Rate

$$-\frac{5 gallons}{6 hours} = \frac{-\frac{5}{6} gallons}{1 hour}$$

Model the amount of water left in the tank as a function of time since the leak began when the tank was full.

Slope = Rate

-5 gallons per 6 hours.

Note that as x increases by 6 hours, y decreases by 5 gallons.

Keeping the constant rate of change, as x increases by 1 hour, y decreases by $\frac{5}{6}$ gallons.

As x increases by 12 hours, y decreases by 10 gallons, and so on.

Equation:

$$y = 500 - \frac{5}{6}x$$

y – intercept

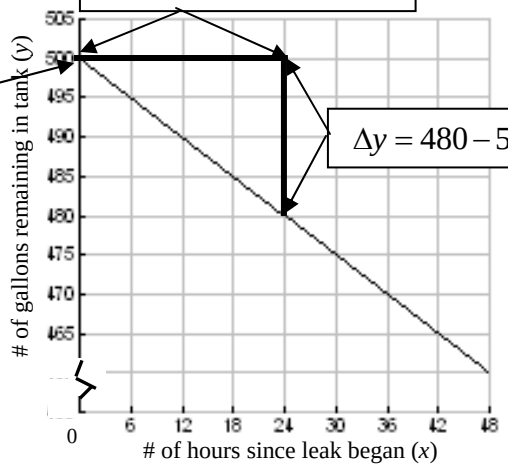
Note that when $x = 0$ hours since the leak began, $y = 500$ gallons.

$$\frac{\Delta y}{\Delta x} = \frac{-20 gallons}{24 hours} = \frac{-5 gallons}{6 hours} = -\frac{5}{6} gallons/hour$$

Graph:

$\Delta x = 24 - 0 = 24$ hours

$\Delta y = 480 - 500 = -20$ gallons



y – intercept

Table:

# of hours since leak began	# of gallons remaining in tank
0	500
1	$499\frac{1}{6}$
6	495
12	490
18	485
24	480

$\Delta x = 24 - 6 = 18$ hours

$\Delta y = 480 - 495 = -15$ gallons

$$\frac{\Delta y}{\Delta x} = \frac{-15 gallons}{18 hours} = \frac{-5 gallons}{6 hours} = \frac{-5}{6} gallons/hour$$

The slope is the rate of change.

The rate of change is the ratio of the change in y to the change in x.

In a linear function, the ratio of the change in y to the change in x is constant.

The slope between *any* two points *anywhere* on the line or in the table is the same $\frac{\Delta y}{\Delta x}$.

33. No 34. Yes 35. No 36. Yes

37.

x	y
–3	5
–2	3
–1	1
0	–1
1	–3
2	–5
3	–7

38.

Number of cups of juice concentrate, x	Number of cups of water, y
0	0
1	$\frac{3}{2}=1\frac{1}{2}$
2	3
3	$4\frac{1}{2}$
4	6
5	$7\frac{1}{2}$
6	9

39.

Number of pounds of apples, x	Number of cups of flour, y
0	0
1	$\frac{2}{5}$
$\frac{5}{2}=2\frac{1}{2}$	1
3	$\frac{6}{5}=1\frac{1}{5}$
5	2
9	$3\frac{3}{5}$
10	4

40. a. fish per week

b. $0 \le x < 4$, $4 \le x < 6$, $6 \le x < 8$, $8 \le x \le 10$

c. $f(x) = \begin{cases} -250x + 1500 & \text{if } 0 \le x < 4 \\ 500 & \text{, if } 4 \le x < 6 \\ 1000x - 5500 & \text{if } 6 \le x < 8 \\ -125x + 3500 & \text{if } 8 \le x \le 10 \end{cases}$

d. During weeks 0 – 4, the fish population changed at a rate of −250 fish per week.

During weeks 4 – 6, the fish population changed at a rate of 0 fish per week.

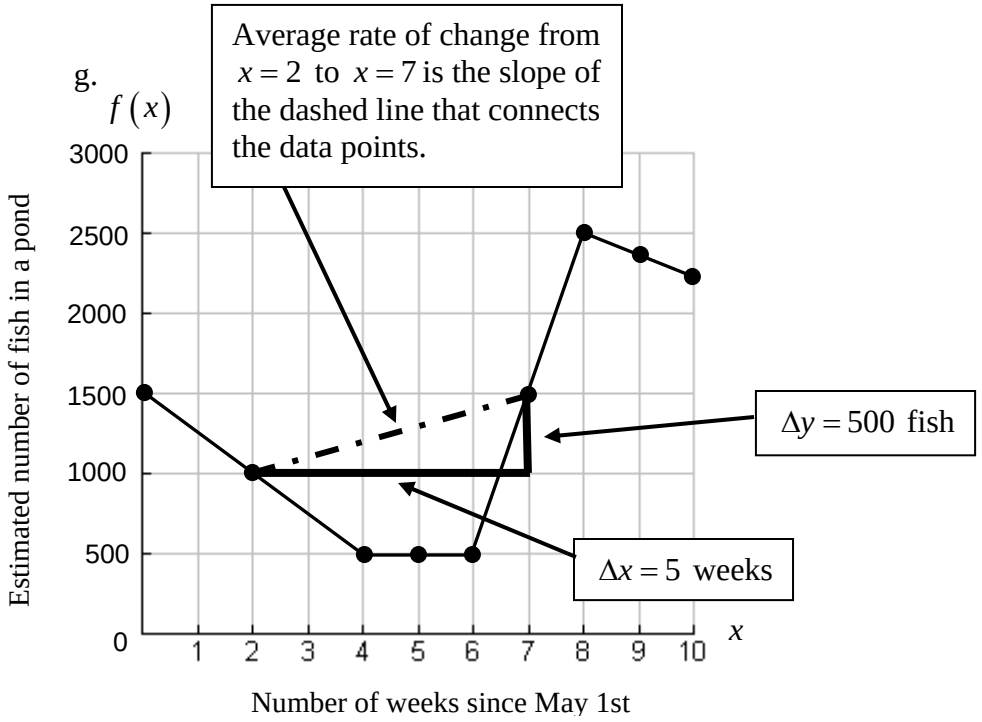
During weeks 6 – 8, the fish population changed at a rate of 1000 fish per week.

During weeks 8 – 10, the fish population changed at a rate of −125 fish per week.

e. 100 fish per week

f. While there was actual variation in the slope during the time interval $x = 2$ to $x = 7$, by the end of the 5 weeks, there were 500 more fish than at the beginning of those five weeks. $\frac{500\,fish}{5 weeks} = \frac{100\,fish}{1 week} = 100\,fish/week$

g.



41. a. No equation. This could be represented by $2300x + 400y$ which is an expression, not an equation. An equation indicates equivalence of expressions on either side of the "=" sign.

b. IV

c. I

42. a. II b. VI c. V

Note: Equation III does not relate to any of the contexts or questions in #41 or #42.

43. $\begin{bmatrix} 2300 & 400 \\ 1 & 1 \end{bmatrix} \bullet \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5800 \\ 5 \end{bmatrix}$

44. a. $y = -.256x + 25.879$

b. $-.256$ feet per year.

c. According to the regression line, the cliff erodes 0.256 feet each year. That is, the distance from the house to the edge of the cliff decreases by 0.256 feet each year.

d. 25.879

e. According to the regression line, the distance from the house to the edge of the cliff was 25.879 feet in 1975.

f. The $y-$intercept in the regression line is not identical to the data point in the table. This is because the regression line is a line of best fit for all data points, and does not necessarily pass through the $y-$intercept.

g. 15.639 feet

h. The year 2076.

45. a. Graph 1
b. Graph 4
c. Graph 3
d. Graph 2
e. Graph 3
f. Graph 1
g. Graph 2
h. Graph 4
i. Graph 1
j. Graph 4
k. Graph 2
l. Graph 3

46.

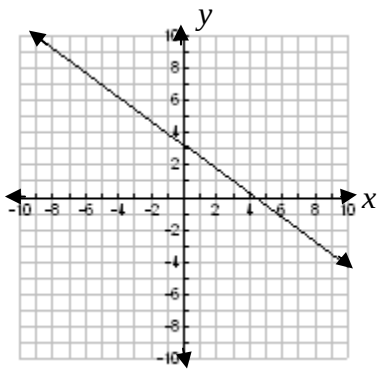
If the two lines have…..	then the lines….	And the number of solutions is ……
	Word Bank	Word Bank
the same slope, and the same *y*-intercept	coincide	infinite
the same slope, and different *y*-intercepts	are parallel	zero
different slopes	intersect	one

47. $x = 1$, $y = -2$. This could also be written as the point, $(1, -2)$.

48. $x = 1$, $y = -2$. This could also be written as the point, $(1, -2)$.

49. The top equations are mathematically equivalent. The bottom equations are also equivalent. If I decided to solve the system using substitution, then I might have begun by transforming the top equation in #47 to become the top equation in #48.

50. a. The equations are mathematically equivalent.
b. Since the lines coincide because they are equivalent, then any coordinate pair along the line is a solution because it satisfies both equations. Thus there are an infinite number of solutions.
c. All of the coordinate pairs along the line.



51. a. The lines have the same slope and different y-intercepts.
b. The lines are parallel, therefore, there are no points that satisfy both equations, and thus there are no solutions.
c. There are no solutions.

52. a. The lines have different slopes, therefore they intersect at one point, which is the solution because that point is the only point that satisfies both equations.
b. There is one solution.
c. $x = 9$, $y = -36$. This can also be written as the coordinate point $(9, -36)$.

53. a. $y = 3000 + 1250x$
b. 3000. It is the sign-on bonus Victor receives before he begins to work at Computer Industries.
c. 1250 dollars per week. Victor would earn $1250 per week at Computer Industries.
d. $y = 1600x$
e. 0. Victor does not receive any money from Ideal Imaging before he begins to work.
f. 1600 dollars per week. Victor would earn $1600 per week at Ideal Imaging.

g. $y = 3000 + 1250x$
$y = 1600x$

h. $x = 8.571, \quad y = 13714.286$ Tthere may be slight variation depending on whether the full or rounded value of x was used to determine y.

i. After about 8 ½ weeks, Victor would have earned about $13,714 whether he worked at Computer Industries or Ideal Imaging. Before this point, his total earnings would have been more at Computer Industries. After this point, his total earnings would be more at Ideal Imaging.

54. a. $y = 800 + 700x$
$y = 450 + 750x$
b. $x = 7$, $y = 5700$. This could also be written as $(7, 5700)$.
c. At 7 months, the cost of his deposit plus rent that he had paid so far would be the same ($5700) whether he lived in Manor Park Apartments or Sunnyside View Apartments. Before this time, it would cost less to live in Sunnyside View Apartments. After this time, it would cost less to live in Manor Park Apartments.

55. a. The total amount of money for which x computers were sold.
b. The total amount of money for which y printers were sold.
c. The total amount of money for which x computers and y printers were sold.
d. They are equal.

e. $2300x + 400y = 5800$.

f. 5

g. $x + y = 5$

h. $2300x + 400y = 5800$
$x + y = 5$

i. $x = 2$, $y = 3$

j. Lisa sold 2 computers and 3 printers.

56. a. $15x + 25y = 110$
$x + y = 6$

b. $x = 4$, $y = 2$

c. Lisa jogged 4 miles and walked 2 miles.

d. $\begin{bmatrix} 15 & 25 \\ 1 & 1 \end{bmatrix} \bullet \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 110 \\ 6 \end{bmatrix}$

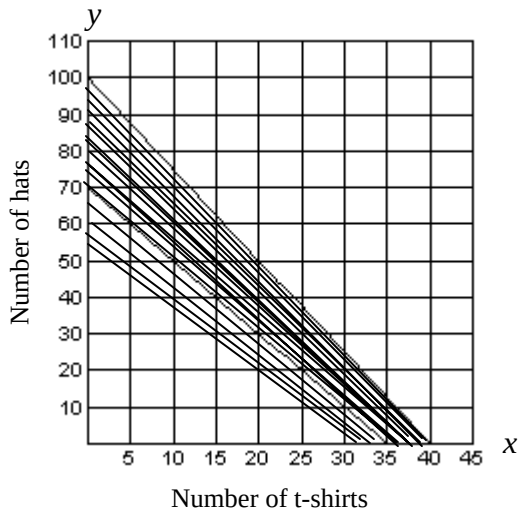
57. a. Graph I. b. Graph II. c. Graph III. d. Graph IV.

58. a.

	Amount of money each item costs the club	Amount of money for which the club will sell each item to students	Profit per item
T-shirt	\$5	\$12	\$7
Hat	\$2	\$6	\$4

b. $5x + 2y \le 200$
$7x + 4y \ge 220$

c. see graph below:

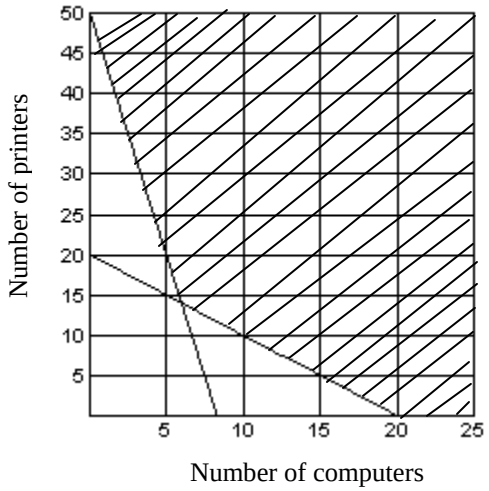


d. Sample responses include: 0 t-shirts and 80 hats 25 t-shirts and 20 hats
15 t-shirts and 50 hats 10 t-shirts and 70 hats 35 t-shirts and 0 hats

59. a. $2400x + 400y \geq 20,000$

$x + y \geq 20$

b. see graph below.

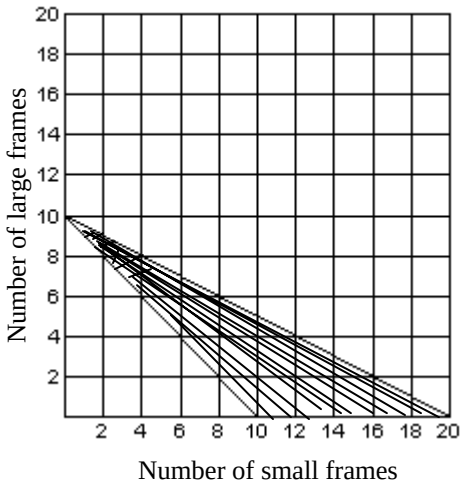


c. Sample responses include:
5 computers and 25 printers
17 computers and 7 printers
10 computers and 15 printers
20 computers and 5 printers
22 computers and 0 printers

60. a. $6x + 12y \leq 120$

$x + y \geq 10$

b. see graph below.



c. Sample responses include:
14 small frames and 2 large frames
20 small frames and 0 large frames
0 small frames and 10 large frames
6 small frames and 6 large frames
8 small frames and 4 large frames

61. Domain is restricted to integers.

$$f(x)=\begin{cases}2x & \text{, if } 1\le x\le 5\\ 10+1(x-5) & \text{, if } x\ge 6\end{cases}$$

62. Domain is restricted to integers (paychecks are discrete).

$$f(x)=\begin{cases}1600x & \text{, if } 1\le x\le 27\\ 1600.27+1648(x-27) & \text{, if } x\ge 28\end{cases}$$

63. a. $\begin{bmatrix}6 & 8\\ 10 & 12\end{bmatrix}$ b. $\begin{bmatrix}6 & 8\\ 10 & 12\end{bmatrix}$ c. They are identical.

64. a . $\begin{bmatrix}-4 & -4\\ -4 & -4\end{bmatrix}$ b. $\begin{bmatrix}4 & 4\\ 4 & 4\end{bmatrix}$ c. They are additive inverses.

65. a. $\begin{bmatrix}19 & 22\\ 43 & 50\end{bmatrix}$ b. $\begin{bmatrix}23 & 34\\ 31 & 46\end{bmatrix}$

c. Multiplication was not commutative with these matrices.

66. a. $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ b. $\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$ c. $\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$

d. They are identical. Multiplication was commutative with the identity matrix, and resulted in the original matrix.

67. a. –2 b. $\begin{bmatrix}-2 & 1\\ \frac{3}{2} & -\frac{1}{2}\end{bmatrix}$ c. $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ d. $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$

e. Multiplying a matrix by its inverse matrix is commutative and results in the identity matrix.

68. a. $\begin{bmatrix}2\\ 3\end{bmatrix}$ b. Lisa sold 2 computers and 3 printers c. Yes

69. a. $\begin{bmatrix}4\\ 2\end{bmatrix}$ b. Lisa ran 4 miles and walked 2 miles c. Yes

70. a. $A=\begin{bmatrix}5&3&2&0&0\\5&2&3&0&0\\3&7&0&0&0\end{bmatrix}$ $B=\begin{bmatrix}4&3&3&0&0\\4&2&2&2&0\\3&4&2&1&0\end{bmatrix}$

$C=\begin{bmatrix}3&2&3&2&0\\3&2&3&1&1\\2&2&2&2&2\end{bmatrix}$ $D=\begin{bmatrix}0&3&2&3&2\\1&2&2&2&3\\0&1&2&4&3\end{bmatrix}$

b. $T=\begin{bmatrix}12&11&10&5&2\\13&8&10&5&4\\8&14&6&7&5\end{bmatrix}$

c. Each entry in T indicates the sum of the number of arrows that a person shot into a particular color over the four rounds. For example, the first entry in T indicates that Trish shot a total of 12 arrows into the white part of the target over the four rounds.

d. $P=\begin{bmatrix}1\\3\\5\\7\\9\end{bmatrix}$ e. Multiply. $TP=\begin{bmatrix}12&11&10&5&2\\13&8&10&5&4\\8&14&6&7&5\end{bmatrix}\begin{bmatrix}1\\3\\5\\7\\9\end{bmatrix}=\begin{bmatrix}148\\158\\174\end{bmatrix}$

f. Trish got 148 points. Tony got 158 points. Val got 174 points.

71. $\frac{1}{2}=0.5=50\%$

72. a. 0 b. $\frac{12}{90}=\frac{2}{15}=0.1\overline{3}=13\frac{1}{3}\%$ c. $\frac{40}{90}=\frac{4}{9}=0.\overline{4}=44.\overline{4}\%$

d. $\frac{12}{40}=\frac{4}{10}=\frac{2}{5}=0.4=40\%$ e. $26!=4.033\times10^{26}$

73. $\left(\frac{1}{175}\right)\left(\frac{1}{174}\right)\left(\frac{1}{173}\right)=\frac{1}{5267850}$

74. $\left(\frac{5}{30}\right)\left(\frac{6}{30}\right)=\frac{1}{30}$