Solutions Manual to Accompany

FINITE MATHEMATICS

Models and Applications

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SOLUTIONS MANUAL TO ACCOMPANY FINITE MATHEMATICS

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LINEAR EQUATIONS AND MATHEMATICAL CONCEPTS

EXERCISES 1.1

1. $3x + 1 = 4x - 5$

$1 = x - 5$

$x = 6$ conditional equation

3. $5(x + 1) + 2(x - 1) = 7x + 6$

$5x + 5 + 2x - 2 = 7x + 6$

$7x + 3 = 7x + 6$ contradiction

5. $4(x + 3) = 2(2x + 5)$

$4x + 12 = 4x + 10$ contradiction

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7. $5x - 3 = 17$

$$5x = 20$$

$$x = 4$$

9. $2x = 4x - 10$

$$2x - 4x = -10$$

$$-2x = -10$$

$$x = 5$$

11. $4x - 5 = 6x - 7$

$$-5 + 7 = 6x - 4x$$

$$2 = 2x$$

$$1 = x$$

13. $0.6x = 30$

$$x = 30/0.60 = 50$$

15. $2/3 = (4/5)x - (1/3)$ multiply by 15 to eliminate fractions

$$1(2/3) = 15\{(4/5)x - (1/3)\}$$

$$10 = 12x - 5$$

$$15 = 12x$$

$$5/4 = x$$

17. $5(x - 4) = 2x + 3(x - 7)$

$$5x - 20 = 2x + 3x - 21$$

$$5x - 20 = 5x - 21$$

No solution

19. $3s - 4 = 2s + 6$

$$s - 4 = 6$$

$$s = 10$$

21. $7t + 2 = 4t + 11$

$7t - 4t = 11 - 2$

$3t = 9$

$t = 3$

23. $4(x + 1) + 2(x - 3) = 7(x - 1)$

$4x + 4 + 2x - 6 = 7x - 7$

$6x - 2 = 7x - 7$

$6x - 7x = -7 + 2$

$x = -5$

$x = 5$

25. $\dfrac{x + 8}{2x - 5} = 2$ multiply by $2x - 5$ to eliminate the fraction

$(x + 8) = 2(2x - 5)$

$x + 8 = 4x - 10$

$8 + 10 = 4x - x$

$18 = 3x$

$6 = x$

(Check the result. Multiplication by a factor such as $2x - 5$ can introduce an extraneous solution.)

27. $8 - \{4[x - (3x - 4) - x] + 4\} = 38 - \{4[x - (3x - 4) - x] + 4\}$

$= 3(x + 2)$

$8 - \{4[x - 3x + 4 - x] + 4\} = 3x + 6$

$8 - \{4[-3x + 4] + 4\} = 3x + 6$

$8 - \{-12x + 16 + 4\} = 3x + 6$

$8 - \{-12x + 20) = 3x + 6$

$8 + 12x - 20 = 3x + 6$

$12x - 12 = 3x + 6$

$9x = 18$

$x = 2$

29. $6x - 3y = 9$ for x

$$6x = 3y + 9$$

$$x = \frac{3y+9}{6} = \frac{1}{2}y + \frac{3}{2}$$

31. $3x + 5y = 15$

$$5y = 15 - 3x$$

$$y = \frac{(15-3x)}{5}$$

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

33. $V = LWH$

$$\frac{V}{LH} = W$$

35. $Z = \dfrac{(x-\mu)}{\sigma}$

$$Z\sigma = x - \mu$$

$$x = Z\sigma + \mu$$

37. Let x = monthly installment ($).
Since Sally paid $300 down, she owes $1300 – $300 = $1000.
Therefore, $5x = 1000$ or $x = \$200$ is the monthly installment.

39. The consumption function is $C(x) = mx + b$. The slope is the "marginal propensity to consume." Therefore, $C(x) = 0.75x + b$. The disposable income, $x = 2$, when consumption is $y = 11$ yields $11 = (0.75)(2) + b$ and $b = 9.5$. The consumption function is $C(x) = 0.75x + 9.5$.

41. a) $d = 4.5(2) = 9$ miles
b) $18 = 4.5t$ and $t = 18/4.5 = 4$ seconds

43. The tax is 6.2% or 0.062 in decimal form, so $T = 0.062x$, where x is $0 \le x \le 87{,}000$.

45. a) $\text{BSA} = 1321 + (0.3433)(20{,}000) = 8187 \text{ cm}^2$
b) $10{,}325 = 1321 + (0.3433)(\text{Wt})$
$9004 = (0.3433)(\text{Wt})$
$9004/0.3433 = 26{,}228\text{ g} = 26.2\text{ kg}$

EXERCISES 1.2

1. Setting $y = 0$ determines the x-intercept and setting $x = 0$ determines the y-intercept.

a) $5x - 3y = 15$ x-intercept 3, y-intercept -5

b) $y = 4x - 5$ x-intercept 5/4, y-intercept -5

c) $2x + 3y = 24$ x-intercept 12, y-intercept 8

d) $9x - y = 18$ x-intercept 2, y-intercept -18

e) $x = 4$ x-intercept 4, no y-intercept(vertical line)

f) $y = -2$ no x-intercept (horizontal line), y-intercept -2

3. The slope is $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

a) (3, 6) and (−1, 4) $m = \dfrac{4-6}{-1-3} = \dfrac{-2}{-4} = \dfrac{1}{2}$

b) (1, 6) and (2, 11) $m = \dfrac{11-6}{2-1} = \dfrac{5}{1} = 5$

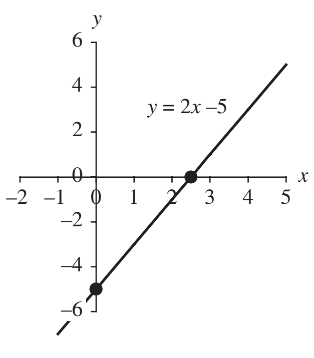
c) (6, 3) and (12, 7) $m = \dfrac{7-3}{12-6} = \dfrac{4}{6} = \dfrac{2}{3}$

d) (2, 3) and (2, 7) $m = \dfrac{7-3}{2-2} = \dfrac{4}{0}$ undefined

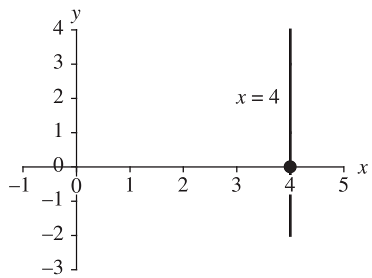
e) (2, 6) and (5, 6) $m = \dfrac{6-6}{5-2} = \dfrac{0}{3} = 0$

f) (5/3, 2/3) and (10/3, 1) $m = \dfrac{1 - {}^2\!/_3}{{}^{10}\!/_3 - {}^5\!/_3} = \dfrac{{}^1\!/_3}{{}^5\!/_3} = \dfrac{1}{5}$

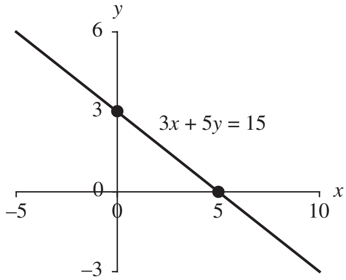
5. a) x-intercept 5/2 and y-intercept -5



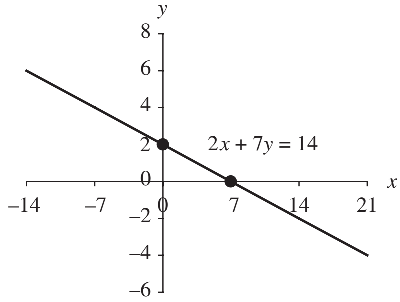
b) x-intercept 4 and no y-intercept



c) x-intercept 5 and y-intercept 3



d) x-intercept 7 and y-intercept 2



7. a) $y = (5/3)x + 2$ and $5x - 3y = 10$; the slope of the first line is 5/3. Solving for y in the second equation yields $y = (5/3)x - (10/3)$. This slope is also 5/3. The slopes are both (5/3) so the lines are parallel (with different intercepts).

b) $6x + 2y = 4$ and $y = (1/3)x + 1$. The slope of the second line is easily determined (line in slope intercept form) as 1/3. Again, solve for y in the first equation to determine $y = -3x + 2$. The slope is -3. The slopes are negative reciprocals; the lines are perpendicular.

c) $2x - 3y = 6$ and $4x - 6y = 15$. Solving for y in each equation, one determines that $y = (2/3)x - 2$ and $y = (2/3)x - (5/2)$. These lines have the same slope (and different intercepts) making them parallel.

d) $y = 5x - 4$ and $3x - y = 4$. The slope of the first line is 5 and solving for y in the second equation, $(y = 3x - 4)$, the slope is 3. These slopes are neither the same nor negative reciprocals. They are neither parallel nor perpendicular.

e) $y = 5$ is a horizontal line while $x = 3$ is a vertical line. The two lines are perpendicular.

9. A linear equation has a single x-intercept except for $y = 0$ (the x-axis) with an infinite number of x-intercepts. Any horizontal line except $y = 0$ has no x-intercepts. Generally, lines do not have more than one y-intercept. The exception is $x = 0$ (the y-axis) with an infinite number of y-intercepts. Any vertical line with the exception of $x = 0$ has no y-intercepts.

11. The ordered pairs of "time" and "machine value" are (0, 75,000) and (9, 21,000), respectively. The slope is

$m = \dfrac{21{,}000 - 75{,}000}{9 - 0} = \dfrac{-54{,}000}{9} = -6000$. The y-intercept is the purchase price, \$75,000. The equation to model the straight-line depreciation is $V(t) = -6000t + 75{,}000$, where $V(t)$ is the machine value (\$) at time t.

13. The ordered pairs (gallons, miles) are (7, 245) and (12, 420).
The slope is $\dfrac{420 - 245}{12 - 7} = \dfrac{175}{5} = 35$ with x gallons and y miles.
Use either pair with the point slope-formula.
Therefore, $y - 245 = 35(x - 7)$ or $y = 35x$.

15. Total cost reflects both fixed and variable costs. The fixed cost is monthly rent (\$1100). The variable cost is $5x$, where x is monthly production. Therefore, total cost is $C(x) = 1100 + 5x$.

17. a) Here, the fixed cost is \$50/day and variable cost \$0.30/mile. To rent the car for a single day costs \$50 to which the mileage cost must be added. The cost is $C(x) = 50 + 0.30x$.

b) If a person has \$110 for rental, the equation to solve for the travel distance is $110 = 50 + 0.30x$.
Solving yields,

$$60 = 0.30x$$
$$\frac{60}{0.30} = x$$
$$200 = x$$

The person can rent the car and travel 200 miles with \$110.

19. Since R is to be a function of C, the ordered pairs are (C, R). The two ordered pairs are (70, 84) and (40, 48). The slope is $\dfrac{48 - 84}{40 - 70} = \dfrac{36}{30} = \dfrac{6}{5}$. Using either pair with the slope to yield $R - 84 = (6/5)(C - 70)$ or $R = (6/5)C$.

EXERCISES 1.3

1. The ordered pair must satisfy each equation to be a solution to the system.

a) $2(3) + 1 = 7$ is true but $3 + 1 = 5$ is not. Therefore, (3, 1) is not a solution to the system.

b) $2(2) + 3 = 7$ is true and so is $2 + 3 = 5$. Therefore, (2, 3) is a solution to the system.

c) $2(4) + 1 = 7$ is true but $4 + (-1) = 5$ is not. Therefore, $(4, -1)$ is not a solution to the system.

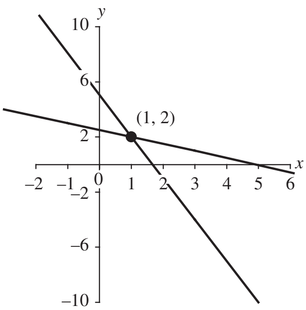
3. a) $y = (-1/3)x + (8/3)$ and $y = -x + 6$, $m_1 = -1/3$ and $m_2 = -1$. Since the slopes differ, this is a consistent system.

b) $y = (-1/2)x + (7/2)$ and $y = (-1/2)x + (7/2)$. Since both the slopes and intercepts are the same, the two equations are the same line. It is a dependent system.

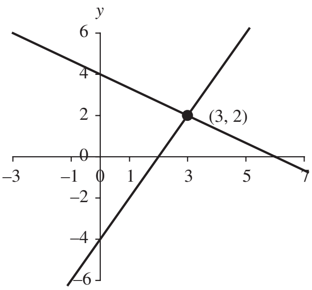
c) $y = (-3/2)x + (7/2)$ and $y = (-3/2)x + 5$. Here, the slopes are the same and the intercepts differ. The lines are parallel and the system is inconsistent.

5. The graphs and solution to each system are:

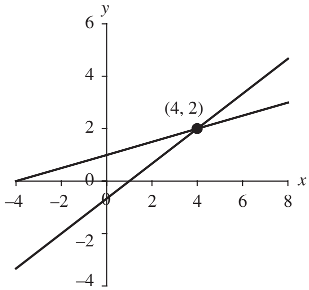
a)



b)



c)



7. a) Given $x = 3$ and substituting in the second equation yields $3 + 3y = 9$, $3y = 6$, and $y = 2$. The ordered pair solution is (3, 2).

b) Using, $y - 2 = 0$, $y = 2$. Substituting into the second equation yields $x + 3(2) = 9$, $x + 6 = 9$, and $x = 3$. The ordered pair solution is (3, 2).

c) The second equation, already solved for y, substituted in the first equation yields $x + (-x + 3) = 5$ or $3 = 5$. This is false, so the system is inconsistent and has no solution.

9. a) Here, x can be eliminated by simply adding the two equations as written.

$$\begin{array}{r} -x + 2y = 5 \\ \underline{x + \ \ y = 4} \\ 3y = 9 \end{array} \text{ or } y = 3$$

Next, use $y = 3$ to determine $x = 1$. The ordered pair solution is (1, 3).

b) Here, y can be eliminated by multiplying the second equation by 3. The system is rewritten as

$$\begin{aligned} 4x + 3y &= 35 \\ 6x - 3y &= 15 \end{aligned}$$

Adding the two equations yields $10x = 50$ or $x = 5$. Using this value for x yields that y is also 5. (Check the solution in the original equation to see that (5, 5) is correct.)

c) The second equation must first be rewritten in standard form $ax + by = c$, so the system to solve is

$$\begin{aligned} x + 4y &= 13 \\ 4x + 2y &= 10 \end{aligned}$$

Multiplying the first equation by -4 will allow x to be eliminated from the system.

$$\begin{array}{r} -4x - 16y = -52 \\ \underline{4x + \ \ 2y = 10} \\ -14y = -42 \end{array} \text{ or } y = 3$$

Using $y = 3$, it is determined that $x = 1$. (Check the solution in the original system to verify the solution (1, 3)).

$\longrightarrow$

d) Rewriting the first equation in standard form and multiplying by 2 to eliminate x yields

$$\begin{array}{r} -2x + 2y = 8 \\ \underline{2x + 3y = 12} \\ 5y = 20 \text{ or } y = 4 \end{array}$$

If $y = 4$, then $x = 0$ and checking in the original system indicates that (0, 4) is the correct solution.

11. Let x represent the number of boxes of cookies and y the boxes of candy. The system to be solved is

$$x + y = 2400$$

$$4x + 5y = 10{,}500$$

Solving yields sales of 1500 boxes of cookies and 900 boxes of candy.

13. Let x = gallons of regular and y = gallons premium. The system of equations to be solved (by either substitution or elimination) is

$$x + y = 100$$

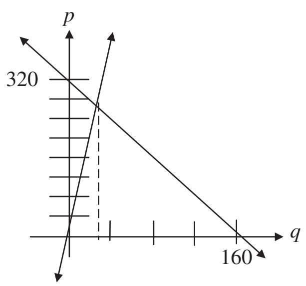
$$0.87x + 0.93\ y = 0.92\ \ (100)$$

Using elimination,

$$\begin{array}{r} -0.87x - 0.87y = -87 \\ \underline{0.87x + 0.93y = 92} \\ 0.06y = 5 \end{array}$$

$y = 83\ 1/3$ gallons and $x = 16\ 2/3$ gallons

15.



The Market equilibrium occurs when q is about 30 and y about 260. Using substitution

$$-2q + 320 = 8q + 20$$
$$300 = 10q$$
$$30 = q$$
so, $p = 260$