## Solutions Manual to Accompany

## FINITE

MATHEMATICS
Models and Applications

CARLA C. MORRIS<br>ROBERT M. STARK

## SOLUTIONS MANUAL TO ACCOMPANY FINITE MATHEMATICS

# SOLUTIONS MANUAL TO ACCOMPANY FINITE MATHEMATICS: MODELS AND APPLICATIONS 

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## CHAPTER 1

## LINEAR EQUATIONS AND MATHEMATICAL CONCEPTS

## EXERCISES 1.1

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

$$
1=x-5
$$

$$
x=6 \quad \text { conditional equation }
$$

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

$$
\begin{aligned}
5 x+5+2 x-2 & =7 x+6 \\
7 x+3 & =7 x+6 \quad \text { contradiction }
\end{aligned}
$$

5. $4(x+3)=2(2 x+5)$
$4 x+12=4 x+10 \quad$ contradiction

[^0]7. $5 x-3=17$
\[

$$
\begin{aligned}
5 x & =20 \\
x & =4
\end{aligned}
$$
\]

9. $2 x=4 x-10$

$$
\begin{aligned}
2 x-4 x & =-10 \\
-2 x & =-10 \\
x & =5
\end{aligned}
$$

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

$$
\begin{aligned}
-5+7 & =6 x-4 x \\
2 & =2 x \\
1 & =x
\end{aligned}
$$

13. $0.6 x=30$

$$
x=30 / 0.60=50
$$

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

$$
\begin{aligned}
1(2 / 3) & =15\{(4 / 5) x-(1 / 3)\} \\
10 & =12 x-5 \\
15 & =12 x \\
5 / 4 & =x
\end{aligned}
$$

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

$$
\begin{aligned}
& 5 x-20=2 x+3 x-21 \\
& 5 x-20=5 x-21
\end{aligned}
$$

No solution
19. $3 s-4=2 s+6$

$$
\begin{aligned}
s-4 & =6 \\
s & =10
\end{aligned}
$$

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

$$
\begin{aligned}
7 t-4 t & =11-2 \\
3 t & =9 \\
t & =3
\end{aligned}
$$

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

$$
\begin{aligned}
4 x+4+2 x-6 & =7 x-7 \\
6 x-2 & =7 x-7 \\
6 x-7 x & =-7+2 \\
x & =-5 \\
x & =5
\end{aligned}
$$

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

$$
\begin{aligned}
(x+8) & =2(2 x-5) \\
x+8 & =4 x-10 \\
8+10 & =4 x-x \\
18 & =3 x \\
6 & =x
\end{aligned}
$$

(Check the result. Multiplication by a factor such as $2 x-5$ can introduce an extraneous solution.)
27. $8-\{4[x-(3 x-4)-x]+4\}=38-\{4[x-(3 x-4)-x]+4\}$

$$
=3(x+2)
$$

$$
\begin{aligned}
8-\{4[x-3 x+4-x]+4\} & =3 x+6 \\
8-\{4[-3 x+4]+4\} & =3 x+6 \\
8-\{-12 x+16+4\} & =3 x+6 \\
8-\{-12 x+20) & =3 x+6 \\
8+12 x-20 & =3 x+6 \\
12 x-12 & =3 x+6 \\
9 x & =18 \\
x & =2
\end{aligned}
$$

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

$$
\begin{aligned}
6 x & =3 y+9 \\
x & =\frac{3 y+9}{6}=\frac{1}{2} y+\frac{3}{2}
\end{aligned}
$$

31. $3 x+5 y=15$

$$
\begin{aligned}
5 y & =15-3 x \\
y & =\frac{(15-3 x)}{5} \\
y & =3-\left(\frac{3}{5}\right) x
\end{aligned}
$$

33. $V=L W H$

$$
\frac{V}{L H}=W
$$

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

$$
\begin{aligned}
Z \sigma & =x-\mu \\
x & =Z \sigma+\mu
\end{aligned}
$$

37. Let $x=$ monthly installment (\$).

Since Sally paid $\$ 300$ down, she owes $\$ 1300-\$ 300=\$ 1000$. Therefore, $5 x=1000$ or $x=\$ 200$ is the monthly installment.
39. The consumption function is $C(x)=m x+b$. The slope is the "marginal propensity to consume." Therefore, $C(x)=0.75 x+b$. The disposable income, $x=2$, when consumption is $y=11$ yields $11=(0.75)(2)+b$ and $b=9.5$. The consumption function is $C(x)=0.75 x+9.5$.
41. a) $d=4.5(2)=9$ miles
b) $18=4.5 t$ and $t=18 / 4.5=4$ seconds
43. The tax is $6.2 \%$ or 0.062 in decimal form, so $T=0.062 x$, where $x$ is $0 \leq x \leq 87,000$.
45. a) $\mathrm{BSA}=1321+(0.3433)(20,000)=8187 \mathrm{~cm}^{2}$
b) $10,325=1321+(0.3433)(\mathrm{Wt})$

$$
\begin{aligned}
& 9004=(0.3433)(\mathrm{Wt}) \\
& 9004 / 0.3433=26,228 \mathrm{~g}=26.2 \mathrm{~kg}
\end{aligned}
$$

## EXERCISES 1.2

1. Setting $y=0$ determines the $x$-intercept and setting $x=0$ determines the $y$-intercept.
a) $5 x-3 y=15 \quad x$-intercept 3, $y$-intercept -5
b) $y=4 x-5 \quad x$-intercept $5 / 4, y$-intercept -5
c) $2 x+3 y=24 \quad x$-intercept $12, y$-intercept 8
d) $9 x-y=18 \quad x$-intercept $2, y$-intercept -18
e) $x=4 \quad x$-intercept 4 , no $y$-intercept(vertical line)
f) $y=-2$ no $\quad x$-intercept (horizontal line), $y$-intercept -2
2. The slope is $m=\frac{y_{2}-y_{1}}{x_{2}-x_{1}}$
a) $(3,6)$ and $(-1,4) \quad m=\frac{4-6}{-1-3}=\frac{-2}{-4}=\frac{1}{2}$
b) $(1,6)$ and $(2,11)$

$$
m=\frac{11-6}{2-1}=\frac{5}{1}=5
$$

c) $(6,3)$ and $(12,7)$ $m=\frac{7-3}{12-6}=\frac{4}{6}=\frac{2}{3}$
d) $(2,3)$ and $(2,7)$ $m=\frac{7-3}{2-2}=\frac{4}{0}$ undefined
e) $(2,6)$ and $(5,6)$ $m=\frac{6-6}{5-2}=\frac{0}{3}=0$
f) $(5 / 3,2 / 3)$ and $(10 / 3,1) m=\frac{1-2 / 3}{10 / 3-5 / 3}=\frac{1 / 3}{5 / 3}=\frac{1}{5}$
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 $5 x-3 y=10$; 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) $6 x+2 y=4$ 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 $y=-3 x+2$. The slope is -3 . The slopes are negative reciprocals; the lines are perpendicular.
c) $2 x-3 y=6$ and $4 x-6 y=15$. 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) $y=5 x-4$ and $3 x-y=4$. The slope of the first line is 5 and solving for $y$ in the second equation, $(y=3 x-4)$, 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
$m=\frac{21,000-75,000}{9-0}=\frac{-54,000}{9}=-6000$. The $y$-intercept is the purchase price, $\$ 75,000$. The equation to model the straight-line depreciation is $V(t)=-6000 t+75,000$, 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 $\frac{420-245}{12-7}=\frac{175}{5}=35$ with $x$ gallons and $y$ miles.
Use either pair with the point slope-formula.
Therefore, $y-245=35(x-7)$ or $y=35 x$.
15. Total cost reflects both fixed and variable costs. The fixed cost is monthly rent ( $\$ 1100$ ). The variable cost is $5 x$, where $x$ is monthly production. Therefore, total cost is $C(x)=1100+5 x$.
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 $C(x)=50+0.30 x$.
b) If a person has $\$ 110$ for rental, the equation to solve for the travel distance is $110=50+0.30 x$.
Solving yields,

$$
\begin{aligned}
60 & =0.30 x \\
\frac{60}{0.30} & =x \\
200 & =x
\end{aligned}
$$

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 $\frac{48-84}{40-70}=\frac{36}{30}=\frac{6}{5}$. 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.
2. 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.
3. The graphs and solution to each system are:
a)

b)

c)

4. a) Given $x=3$ and substituting in the second equation yields $3+3 y=9,3 y=6$, 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.
5. a) Here, $x$ can be eliminated by simply adding the two equations as written.

$$
\begin{aligned}
-x+2 y & =5 \\
x+y & =4 \\
\hline 3 y & =9
\end{aligned} \text { or } y=3
$$

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

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

Adding the two equations yields $10 x=50$ 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 $a x+b y=c$, so the system to solve is

$$
\begin{array}{r}
x+4 y=13 \\
4 x+2 y=10
\end{array}
$$

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

$$
\begin{aligned}
-4 x-16 y & =-52 \\
4 x+2 y & =10 \\
\hline-14 y & =-42 \text { or } y=3
\end{aligned}
$$

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

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

$$
\begin{aligned}
-2 x+2 y & =8 \\
2 x+3 y & =12 \\
\hline 5 y & =20 \text { or } y=4
\end{aligned}
$$

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

$$
\begin{aligned}
x+y & =2400 \\
4 x+5 y & =10,500
\end{aligned}
$$

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

$$
\begin{aligned}
x+y & =100 \\
0.87 x+0.93 y & =0.92
\end{aligned}
$$

Using elimination,

$$
\begin{aligned}
-0.87 x-0.87 y & =-87 \\
0.87 x+0.93 y & =92 \\
\hline 0.06 y & =5 \\
y & =83 \quad 1 / 3 \text { gallons and } x=162 / 3 \text { gallons }
\end{aligned}
$$

15. 



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

$$
\begin{aligned}
-2 q+320 & =8 q+20 \\
300 & =10 q \\
30 & =q \\
\text { so, } p & =260
\end{aligned}
$$


[^0]:    Solutions Manual to Accompany Finite Mathematics: Models and Applications, First Edition. Carla C. Morris and Robert M. Stark.
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