Math 135: Intermediate Algebra Homework 11 Solutions

## Section 4.2

Solve by substitution:
1.

$$
\begin{aligned}
& y=x-3 \\
& y=2 x+1
\end{aligned}
$$

Answer:

$$
\begin{aligned}
x-3 & =2 x+1 \\
-4 & =x \\
y & =-4-3 \\
y & =-7
\end{aligned}
$$

3. 

$$
\begin{aligned}
& y=\frac{1}{2} x+3 \\
& x=4 y+6
\end{aligned}
$$

Answer:

$$
\begin{aligned}
y & =\frac{1}{2}(4 y+6)+3 \\
y & =2 y+6 \\
-6 & =y \\
x & =4(-6)+6 \\
x & =-18
\end{aligned}
$$

5. 

$$
\begin{aligned}
3 x+2 y & =-8 \\
y & =-4 x+11
\end{aligned}
$$

Answer:

$$
\begin{aligned}
3 x+2(-4 x+11) & =-8 \\
-5 x+22 & =-8 \\
x & =6 \\
y & =-4(6)+11 \\
y & =-13
\end{aligned}
$$

9. 

$$
\begin{aligned}
7 y & =21-14 x \\
-5 y & =20 x
\end{aligned}
$$

Answer:

$$
\begin{aligned}
y & =-4 x \\
7(-4 x) & =21-14 x \\
-28 x & =21-14 x \\
x & =-\frac{3}{2} \\
y & =-4\left(-\frac{3}{2}\right) \\
y & =6
\end{aligned}
$$

11. 

$$
\begin{aligned}
10 a-b & =5 \\
10 a+3 b & =-7
\end{aligned}
$$

Answer:

$$
\begin{aligned}
b & =10 a-5 \\
10 a+3(10 a-5) & =-7 \\
40 a-15 & =-7 \\
a & =\frac{1}{5} \\
b & =10\left(\frac{1}{5}\right)-5 \\
b & =-3
\end{aligned}
$$

13. 

$$
\begin{aligned}
& x-5 y=-1 \\
& 7 x-y=10
\end{aligned}
$$

Answer:

$$
\begin{aligned}
x & =5 y-1 \\
7(5 y-1)-y & =10 \\
34 y-7 & =10 \\
y & =\frac{1}{2} \\
x & =5\left(\frac{1}{2}\right)-1 \\
x & =\frac{3}{2}
\end{aligned}
$$

Solve by elimination:
21.

$$
\begin{aligned}
& x+y=3 \\
& x-y=5
\end{aligned}
$$

Answer:

$$
\begin{aligned}
& x+y=3 \\
&+(x-y)=+5 \\
& \hline
\end{aligned}
$$

$$
\begin{aligned}
2 x & =8 \\
x & =4 \\
4+y & =3 \\
y & =-1
\end{aligned}
$$

23. 

$$
\begin{aligned}
& 3 x+2 y=-2 \\
& 3 x-3 y=1
\end{aligned}
$$

Answer:

$$
\begin{aligned}
-3 x+2 y & =-2 \\
+(3 x-3 y) & =+1 \\
\hline-y & =-1 \\
y & =1 \\
-3 x+2(1) & =-2 \\
-3 x+2 & =-2 \\
x & =\frac{4}{3}
\end{aligned}
$$

25. 

$$
\begin{aligned}
& 2 x-5 y=7 \\
& 6 x-5 y=-3
\end{aligned}
$$

Answer:

$$
\begin{aligned}
& 2 x-5 y=7 \\
&-(6 x-5 y)=-(-3) \\
& \hline
\end{aligned}
$$

$$
-4 x=10
$$

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

$$
2\left(-\frac{5}{2}\right)-5 y=7
$$

$$
-5-5 y=7
$$

$$
y=-\frac{12}{5}
$$

27. 

$$
\begin{aligned}
& 7 c+3 d=0 \\
& 7 c-9 d=0
\end{aligned}
$$

Answer:

$$
\begin{aligned}
7 c+3 d & =0 \\
-(7 c-9 d) & =-0 \\
\hline 12 d & =0 \\
d & =0 \\
7 c+3(0) & =0 \\
7 c & =0 \\
c & =0
\end{aligned}
$$

37. 

$$
\begin{aligned}
& 3 x+4 y=1 \\
& 2 x-3 y=12
\end{aligned}
$$

Answer:

$$
\begin{aligned}
& 2(3 x+4 y)=2(1) \\
&-3(2 x-3 y)=-3(12) \\
& \hline
\end{aligned}
$$

$$
\begin{aligned}
& 6 x+8 y=2 \\
&-6 x+9 y=-36 \\
& \hline
\end{aligned}
$$

$$
\begin{aligned}
17 y & =-34 \\
y & =-2 \\
3 x+4(-2) & =1 \\
3 x-8 & =1 \\
x & =3
\end{aligned}
$$

39. 

$$
\begin{aligned}
& 5 x+2 y=11 \\
& 4 x+7 y=-2
\end{aligned}
$$

Answer:

$$
\begin{aligned}
& 4(5 x+2 y)=4(11) \\
&-5(4 x+7 y)=-5(-2) \\
& \hline
\end{aligned}
$$

$$
20 x+8 y=44
$$

$$
-20 x-35 y=10
$$

$$
\begin{aligned}
-27 y & =54 \\
y & =-2 \\
5 x+2(-2) & =11 \\
5 x-4 & =11 \\
x & =3
\end{aligned}
$$

45. Uptown Towing Company charges $\$ 60$ to tow a car plus $\$ 25$ per day for vehicle storage. Downtown Towing Company charges $\$ 75$ for towing plus $\$ 20$ per day for vehicle storage.
a. Write an equation that shows how much each company charges in terms of the number of days of storage.
Answer:
Let $c$ be the cost and $d$ be the number of days of storage. For Uptown Towing, $c=25 d+60$. For Downtown Towing, $c=20 d+75$.
b. For how many days of storage will both companies charge the same?
Answer:

$$
\begin{aligned}
25 d+60 & =20 d+75 \\
5 d & =15 \\
d & =3
\end{aligned}
$$

They charge the same for 3 days of storage.
47. A homeowner sections off part of her backyard for a vegetable garden. The width of the garden is 4 ft shorter than the length. The total perimeter of the garden is 52 ft . What are the dimensions of the garden?
Answer:
Let $l$ be the length and $w$ be the width. The perimeter is $2 l+2 w$ (two sides of length $l$, two of length $w$ ), so we know $2 l+2 w=52$. Since the width is four feet shorter than the length, we also have $w=l-4$. Solving,

$$
\begin{aligned}
2 l+2 w & =52 \\
w & =l-4 \\
2 l+2(l-4) & =52 \\
4 l-8 & =52 \\
l & =15 \\
w & =15-4 \\
w & =11
\end{aligned}
$$

So the width is 11 ft and the length is 15 ft .
49. On a riverboat trip up the Wailua River in Kauai, a boat traveled against the current at an average speed of 18 mph . On the return trip down the river, the boat traveled with the current at an average speed of 22 mph .
a. Express this information as a system of equations.
Answer:
Let $b$ be the speed of the boat in still water, and $r$ be the speed of the river. Then on the trip up the river, $b-r=18$, and on the trip down the river, $b+r=22$.
b. Find the speed of the boat in still water and the speed of the current.
Answer:

$$
\begin{aligned}
b-r & =18 \\
b+r & =22 \\
2 b & =40 \\
b & =20 \\
20-r & =18 \\
r & =2
\end{aligned}
$$

So the speed of the boat in still water is 18 miles per hour, and the speed of the current in the river is 2 miles per hour.
51. A coffee shop sells 12 -oz and 20 -oz cups of coffee. On a particular day, the shop sold a total of 508 cups of coffee. If the shop sold three times as many $20-$ oz cups of coffee as $12-$ oz cups of coffee, how many cups of each size did the coffee shop sell that day?
Answer:
Let $s$ be the number of small (12-oz) cups it sold, and $l$ be the number of large ( $20-\mathrm{oz}$ ) cups it sold. It sold three times as many large cups, so $l=3 s$, and a total of 508 cups, so $l+s=508$. Then we have

$$
\begin{aligned}
l & =3 s \\
l+s & =508 \\
3 s+s & =508 \\
s & =127 \\
l & =3(127) \\
l & =381
\end{aligned}
$$

The store sold $12712-$ oz cups and $38120-\mathrm{oz}$ cups.
53. A public storage facility rents small and large storage lockers. A small storage locker has 200 sq ft of storage space and a large storage locker has 800 sq ft of storage space. The facility has 54 storage lockers and a total of $22,800 \mathrm{sq} \mathrm{ft}$ of storage space. How many large storage lockers does the facility have?
Answer:
Let $s$ be the number of small ( 200 sq . ft.) lockers, and $l$ be the number of large ( $800 \mathrm{sq.ft}$. ) lockers. Making a table

|  | Number | Locker size | Total size |
| :---: | :---: | :---: | :---: |
| Small | $s$ | 200 | 200 s |
| Large | $l$ | 800 | 8001 |

The total number of lockers is 54 , so $l+s=54$, and the total space available is $22,800 \mathrm{sq}$. ft . so $200 s+800 l=22,800$. Solving,

$$
\begin{aligned}
200(s+l) & =200(54) \\
200 s+200 l & =10,800 \\
-(200 s+800 l) & =-22,800 \\
-600 l & =-12,000 \\
l & =30 \\
s+30 & =54 \\
s & =24
\end{aligned}
$$

So the facility has 24200 sq. ft. lockers and 30 800 sq. ft. lockers.
55. Twice the amount of money that was invested in a low-risk fund was invested in a high-risk fund. After one year, the low-risk earned $6 \%$ and the high-risk fund lost $9 \%$. The investments had a net loss of $\$ 210$. How much was invested in each fund?
Answer:
Let $l$ be the amount invested in the low risk fund and $h$ be the amount invested in the high risk fund. Making a table:

| Risk | Amount | Rate | Total return |
| :---: | :---: | :---: | :---: |
| Low | $l$ | 0.06 | $0.06 l$ |
| High | $h$ | -0.09 | $-0.09 h$ |

The total return is $-\$ 210$, so we have $0.06 l-$ $0.09 h=-210$. We also know twice as much was invested in the high risk fund as in the low risk fund, so $h=2 l$. Solving,

$$
\begin{aligned}
h & =2 l \\
0.06 l-0.09 h & =-210 \\
0.06 l-0.09(2 l) & =-210 \\
-0.12 l & =-210 \\
l & =1,750 \\
h & =2(1,750) \\
h & =3,500
\end{aligned}
$$

So $\$ 3,500$ was invested in the high risk fund, and $\$ 1,750$ in the low risk fund.

Section 7.1 Evaluate, if possible:

1. $\sqrt{64}=8$
2. $-\sqrt{100}=-10$
3. $2 \sqrt{16}=2(4)=8$
4. $\sqrt[3]{27}=3$
5. $5 \sqrt[3]{-8}=5(-2)=-10$
6. $\sqrt[4]{256}=4$
7. $\sqrt{\frac{9}{16}}=\frac{3}{4}$
8. $\sqrt[3]{-\frac{8}{125}}=-\frac{2}{5}$
9. $\sqrt{0.04}=0.2$
10. Problem requires calculator, not graded.
11. Problem requires calculator, not graded.

Simplify:
33. $\sqrt{x^{8}}=x^{4}$
35. $\sqrt{16 a^{6}}=4 a^{3}$
37. $9 \sqrt{p^{8} q^{4}}=9 p^{4} q^{2}$

Rewrite using radical notation. Then simplify, if possible.
49. $16^{1 / 2}=\sqrt{16}=4$
51. $-16^{1 / 2}=-\sqrt{16}=-4$
61. $27^{4 / 3}=(\sqrt[3]{27})^{4}=3^{4}=81$
63. $-16^{3 / 2}=-(\sqrt{16})^{3}=-4^{3}=-64$

Solve:
93. If an object is dropped, the time (in seconds) it takes the object to fall $s \mathrm{ft}$ is given by the expression $\frac{1}{4} \sqrt{s}$. Find the time it takes a stone dropped from a height of 100 ft to reach the ground.
Answer:
The time required is $\frac{1}{4} \sqrt{100}=\frac{1}{4} 10=2.5 \mathrm{sec}$ onds.
95. The length of the side of square with area $A$ can be computed using the expression $\sqrt{A}$. The area of the square picture frame, including the 1 -in. wood border, is $25 \mathrm{in}^{2}$.
a. Find $x$, the length of the side of the picture frame.
Answer:
$x=\sqrt{25}=5$. The length of a side of the picture is 5 in.
b. What size photopraph fits in the frame?

Answer:
The border is 1 in , and there are borders on both sides, to the area allowed for the picture is 3 in by 3 in .
97. The manager of an office uses the expression $8000(0.5)^{t / 3}$ to calculate the value of a piece of office equipment $t$ years after it was purchased new for $\$ 8000$.
a. Write this expression in radical form.

Answer:
$8000(0.5)^{t / 3}=8000 \sqrt[3]{0.5}^{t}$
b. Find the value of the equipment 6 yr after it was purchased.
Answer:
The value is $8000(0.5)^{6 / 3}=8000(0.5)^{2}=$ 2000 . The value is $\$ 2000$.

