### 4.4 Equations of the Form $a x+b=c x+d$

We continue our study of equations in which the variable appears on both sides of the equation. Suppose we are given the equation:

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

Our first step is to convert the equation to one of the form $a x+b=c$, from the last section. Note that the Addition property of equations allows us to add the same quantity to each side of the equation. This quantity can also be an expression (rather than a number). To eliminate the $5 x$ term on the right-hand side of the equation, we will add its opposite $-5 x$ to each side of the equation:

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

We can now solve the equation as we did in the previous section:

$$
\begin{aligned}
-2 x+4 & =-6 \\
-2 x+4+(-4) & =-6+(-4) \\
-2 x & =-10 \\
-\frac{1}{2} \cdot(-2 x) & =-\frac{1}{2} \cdot(-10) \\
x & =5
\end{aligned}
$$

To check our solution, we substitute $x=5$ into both sides of the equation:

$$
\begin{aligned}
3 \cdot 5+4 & =5 \cdot 5-6 \\
15+4 & =25-6 \\
19 & =19
\end{aligned}
$$

Note that we could have also solved the equation by adding $-3 x$ (the opposite of $3 x$ ) to each side of the equation:

$$
\begin{aligned}
3 x+(-3 x)+4 & =5 x+(-3 x)-6 \\
4 & =2 x-6 \\
4+6 & =2 x-6+6 \\
10 & =2 x \\
\frac{1}{2} \cdot 10 & =\frac{1}{2} \cdot 2 x \\
5 & =x
\end{aligned}
$$

Note that the solution is the same (although the variable appears on the right-hand side).
Generally we will add the variable to the left-hand side, primarily for consistency with the last section.

Example 1 Solve the following equations. Include a check of your solution.
a. $\quad 5 x+3=2 x-9$
b. $\quad 4 y-5=-2 y-17$
c. $-3 x+2=2 x-6$
d. $\quad 2 a-3=5 a-7$

Solution a. First add $-2 x$ to each side of the equation, then solve the resulting equation:

$$
\begin{aligned}
5 x+3 & =2 x-9 \\
5 x+(-2 x)+3 & =2 x+(-2 x)-9 \\
3 x+3 & =-9 \\
3 x+3+(-3) & =-9+(-3) \\
3 x & =-12 \\
\frac{1}{3} \cdot 3 x & =\frac{1}{3} \bullet(-12) \\
x & =-4
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
5(-4)+3 & =2(-4)-9 \\
-20+3 & =-8-9 \\
-17 & =-17
\end{aligned}
$$

b. First add $2 y$ to each side of the equation, then solve the resulting equation:

$$
\begin{aligned}
4 y-5 & =-2 y-17 \\
4 y+2 y-5 & =-2 y+2 y-17 \\
6 y-5 & =-17 \\
6 y-5+5 & =-17+5 \\
6 y & =-12 \\
\frac{1}{6} \bullet 6 y & =\frac{1}{6} \bullet(-12) \\
y & =-2
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
4(-2)-5 & =-2(-2)-17 \\
-8-5 & =4-17 \\
-13 & =-13
\end{aligned}
$$

c. First add $-2 x$ to each side of the equation, then solve the resulting equation:

$$
\begin{aligned}
-3 x+2 & =2 x-6 \\
-3 x+(-2 x)+2 & =2 x+(-2 x)-6 \\
-5 x+2 & =-6 \\
-5 x+2+(-2) & =-6+(-2) \\
-5 x & =-8 \\
-\frac{1}{5} \cdot(-5 x) & =-\frac{1}{5} \bullet(-8) \\
x & =\frac{8}{5}
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
-3 \cdot \frac{8}{5}+2 & =2 \cdot \frac{8}{5}-6 \\
-\frac{24}{5}+2 & =\frac{16}{5}-6 \\
-\frac{24}{5}+\frac{10}{5} & =\frac{16}{5}-\frac{30}{5} \\
-\frac{14}{5} & =-\frac{14}{5}
\end{aligned}
$$

d. First add $-5 a$ to each side of the equation, then solve the resulting equation:

$$
\begin{aligned}
2 a-3 & =5 a-7 \\
2 a+(-5 a)-3 & =5 a+(-5 a)-7 \\
-3 a-3 & =-7 \\
-3 a-3+3 & =-7+3 \\
-3 a & =-4 \\
-\frac{1}{3} \cdot(-3 a) & =-\frac{1}{3} \cdot(-4) \\
a & =\frac{4}{3}
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
2 \cdot \frac{4}{3}-3 & =5 \cdot \frac{4}{3}-7 \\
\frac{8}{3}-3 & =\frac{20}{3}-7 \\
\frac{8}{3}-\frac{9}{3} & =\frac{20}{3}-\frac{21}{3} \\
-\frac{1}{3} & =-\frac{1}{3}
\end{aligned}
$$

As in the previous section, equations which contain fractions are best solved by multiplying by the LCM of all fractions within the equation. The next example illustrates this technique further.

Example 2 Solve each equation by first eliminating fractions. Include a check of your solution.
a. $\quad \frac{1}{2} x+\frac{3}{4}=x-\frac{2}{3}$
b. $\frac{1}{3} y-\frac{1}{2}=y-\frac{1}{3}$
c. $\frac{1}{6} s-\frac{3}{4}=\frac{1}{4} s-\frac{2}{3}$
d. $2.4 t-1.3=4.4 t-5.6$

Solution
a. The LCM of 2,4 , and 3 is 12 . Multiplying each side of the equation by 12 and solving the resulting equation:

$$
\begin{aligned}
\frac{1}{2} x+\frac{3}{4} & =x-\frac{2}{3} \\
12\left(\frac{1}{2} x+\frac{3}{4}\right) & =12\left(x-\frac{2}{3}\right) \\
12 \cdot \frac{1}{2} x+12 \cdot \frac{3}{4} & =12 x-12 \cdot \frac{2}{3} \\
6 x+9 & =12 x-8 \\
6 x+(-12 x)+9 & =12 x+(-12 x)-8 \\
-6 x+9 & =-8 \\
-6 x+9-9 & =-8-9 \\
-6 x & =-17 \\
-\frac{1}{6} \cdot(-6 x) & =-\frac{1}{6} \bullet(-17) \\
x & =\frac{17}{6}
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
\frac{1}{2} \cdot \frac{17}{6}+\frac{3}{4} & =\frac{17}{6}-\frac{2}{3} \\
\frac{17}{12}+\frac{3}{4} & =\frac{17}{6}-\frac{2}{3} \\
\frac{17}{12}+\frac{9}{12} & =\frac{17}{6}-\frac{4}{6} \\
\frac{26}{12} & =\frac{13}{6} \\
\frac{13}{6} & =\frac{13}{6}
\end{aligned}
$$

b. The LCM of 3 and 2 is 6 . Multiplying each side of the equation by 6 and solving the resulting equation:

$$
\begin{aligned}
\frac{1}{3} y-\frac{1}{2} & =y-\frac{1}{3} \\
6\left(\frac{1}{3} y-\frac{1}{2}\right) & =6\left(y-\frac{1}{3}\right) \\
6 \cdot \frac{1}{3} y-6 \cdot \frac{1}{2} & =6 y-6 \cdot \frac{1}{3} \\
2 y-3 & =6 y-2 \\
2 y+(-6 y)-3 & =6 y+(-6 y)-2 \\
-4 y-3 & =-2 \\
-4 y-3+3 & =-2+3 \\
-4 y & =1 \\
-\frac{1}{4} \cdot(-4 y) & =-\frac{1}{4} \bullet 1 \\
y & =-\frac{1}{4}
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
\frac{1}{3} \cdot\left(-\frac{1}{4}\right)-\frac{1}{2} & =-\frac{1}{4}-\frac{1}{3} \\
-\frac{1}{12}-\frac{1}{2} & =-\frac{1}{4}-\frac{1}{3} \\
-\frac{1}{12}-\frac{6}{12} & =-\frac{3}{12}-\frac{4}{12} \\
-\frac{7}{12} & =-\frac{7}{12}
\end{aligned}
$$

c. The LCM of 6,4 , and 3 is 12 . Multiplying each side of the equation by 12 and solving the resulting equation:

$$
\begin{aligned}
\frac{1}{6} s-\frac{3}{4} & =\frac{1}{4} s-\frac{2}{3} \\
12\left(\frac{1}{6} s-\frac{3}{4}\right) & =12\left(\frac{1}{4} s-\frac{2}{3}\right) \\
12 \cdot \frac{1}{6} s-12 \cdot \frac{3}{4} & =12 \cdot \frac{1}{4} s-12 \cdot \frac{2}{3} \\
2 s-9 & =3 s-8 \\
2 s+(-3 s)-9 & =3 s+(-3 s)-8 \\
-s-9 & =-8 \\
-s-9+9 & =-8+9 \\
-s & =1 \\
-1 \cdot(-s) & =-1 \cdot 1 \\
s & =-1
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
\frac{1}{6} \cdot(-1)-\frac{3}{4} & =\frac{1}{4} \cdot(-1)-\frac{2}{3} \\
-\frac{1}{6}-\frac{3}{4} & =-\frac{1}{4}-\frac{2}{3} \\
-\frac{2}{12}-\frac{9}{12} & =-\frac{3}{12}-\frac{8}{12} \\
-\frac{11}{12} & =-\frac{11}{12}
\end{aligned}
$$

d. This equation may not appear to contain fractions, but remember that the decimals in this equation each represent tenths. Multiplying each side of the equation by 10 and solving the resulting equation:

$$
\begin{aligned}
2.4 t-1.3 & =4.4 t-5.6 \\
10(2.4 t-1.3) & =10(4.4 t-5.6) \\
10 \cdot 2.4 t-10 \cdot 1.3 & =10 \bullet 4.4 t-10 \cdot 5.6 \\
24 t-13 & =44 t-56 \\
24 t+(-44 t)-13 & =44 t+(-44 t)-56 \\
-20 t-13 & =-56 \\
-20 t-13+13 & =-56+13 \\
-20 t & =-43 \\
-\frac{1}{20} \bullet(-20 t) & =-\frac{1}{20} \bullet(-43) \\
t & =\frac{43}{20} \\
t & =2.15
\end{aligned}
$$

Note that we converted the fractional answer to a decimal, since the original equation involved decimals. Checking the solution:

$$
\begin{aligned}
2.4 \cdot 2.15-1.3 & =4.4 \cdot 2.15-5.6 \\
5.16-1.3 & =9.46-5.6 \\
3.86 & =3.86
\end{aligned}
$$

We now are armed with the techniques for solving all equations of the form $a x+b=c x+d$. Recall in Section 4.2 we simplified expressions by combining like terms. We now include some of those expressions into the form of equations. Suppose we are given the equation:

$$
3(2 x-4)=-2(x+4)
$$

Begin by simplifying each side of the equation (using the distributive property):

$$
\begin{aligned}
3(2 x-4) & =-2(x+4) \\
3 \cdot 2 x-3 \cdot 4 & =-2 x+(-2) \cdot 4 \\
6 x-12 & =-2 x-8
\end{aligned}
$$

Now solve the equation as in the previous example:

$$
\begin{aligned}
6 x-12 & =-2 x-8 \\
6 x+2 x-12 & =-2 x+2 x-8 \\
8 x-12 & =-8 \\
8 x-12+12 & =-8+12 \\
8 x & =4 \\
\frac{1}{8} \cdot 8 x & =\frac{1}{8} \bullet 4 \\
x & =\frac{1}{2}
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
3\left(2 \cdot \frac{1}{2}-4\right) & =-2\left(\frac{1}{2}+4\right) \\
3(1-4) & =-2\left(\frac{1}{2}+\frac{8}{2}\right) \\
3(-3) & =-2\left(\frac{9}{2}\right) \\
-9 & =-9
\end{aligned}
$$

The next example will provide additional practice in solving these equations.
Example 3 Solve the following equations. Include a check of your solution.
a. $\quad 5(x-2)=3(2 x+1)$
b. $\quad 4(2 y-1)=3(3 y+2)$
c. $\quad-2(3 b-2)=3(2 b+1)$
d. $\frac{1}{2}(5 w-4)=\frac{1}{3}(2 w+1)$

Solution a. Apply the distributive property then solve the resulting equation:

$$
\begin{aligned}
5(x-2) & =3(2 x+1) \\
5 x-10 & =6 x+3 \\
5 x+(-6 x)-10 & =6 x+(-6 x)+3 \\
-x-10 & =3 \\
-x-10+10 & =3+10 \\
-x & =13 \\
-1 \cdot(-x) & =-1 \cdot 13 \\
x & =-13
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
5(-13-2) & =3(2 \cdot(-13)+1) \\
5(-15) & =3(-26+1) \\
-75 & =3(-25) \\
-75 & =-75
\end{aligned}
$$

b. Apply the distributive property then solve the resulting equation:

$$
\begin{aligned}
4(2 y-1) & =3(3 y+2) \\
8 y-4 & =9 y+6 \\
8 y+(-9 y)-4 & =9 y+(-9 y)+6 \\
-y-4 & =6 \\
-y-4+4 & =6+4 \\
-y & =10 \\
-1 \cdot(-y) & =-1 \cdot 10 \\
y & =-10
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
4(2 \cdot(-10)-1) & =3(3 \cdot(-10)+2) \\
4(-20-1) & =3(-30+2) \\
4(-21) & =3(-28) \\
-84 & =-84
\end{aligned}
$$

c. Apply the distributive property then solve the resulting equation:

$$
\begin{aligned}
-2(3 b-2) & =3(2 b+1) \\
-6 b+4 & =6 b+3 \\
-6 b+(-6 b)+4 & =6 b+(-6 b)+3 \\
-12 b+4 & =3 \\
-12 b+4+(-4) & =3+(-4) \\
-12 b & =-1 \\
-\frac{1}{12} \bullet(-12 b) & =-\frac{1}{12} \cdot(-1) \\
b & =\frac{1}{12}
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
-2\left(3 \cdot \frac{1}{12}-2\right) & =3\left(2 \cdot \frac{1}{12}+1\right) \\
-2\left(\frac{1}{4}-2\right) & =3\left(\frac{1}{6}+1\right) \\
-2\left(\frac{1}{4}-\frac{8}{4}\right) & =3\left(\frac{1}{6}+\frac{6}{6}\right) \\
-2\left(-\frac{7}{4}\right) & =3\left(\frac{7}{6}\right) \\
\frac{7}{2} & =\frac{7}{2}
\end{aligned}
$$

d. Apply the distributive property, clear the equation of fractions by multiplying by the LCM, then solve the resulting equation:

$$
\begin{aligned}
\frac{1}{2}(5 w-4) & =\frac{1}{3}(2 w+1) \\
\frac{5}{2} w-2 & =\frac{2}{3} w+\frac{1}{3} \\
6\left(\frac{5}{2} w-2\right) & =6\left(\frac{2}{3} w+\frac{1}{3}\right) \\
6 \cdot \frac{5}{2} w-6 \cdot 2 & =6 \cdot \frac{2}{3} w+6 \cdot \frac{1}{3} \\
15 w-12 & =4 w+2 \\
15 w+(-4 w)-12 & =4 w+(-4 w)+2 \\
11 w-12 & =2 \\
11 w-12+12 & =2+12 \\
11 w & =14 \\
\frac{1}{11} \cdot 11 w & =\frac{1}{11} \bullet 14 \\
w & =\frac{14}{11}
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
\frac{1}{2}\left(5 \cdot \frac{14}{11}-4\right) & =\frac{1}{3}\left(2 \cdot \frac{14}{11}+1\right) \\
\frac{1}{2}\left(\frac{70}{11}-4\right) & =\frac{1}{3}\left(\frac{28}{11}+1\right) \\
\frac{1}{2}\left(\frac{70}{11}-\frac{44}{11}\right) & =\frac{1}{3}\left(\frac{28}{11}+\frac{11}{11}\right) \\
\frac{1}{2}\left(\frac{26}{11}\right) & =\frac{1}{3}\left(\frac{39}{11}\right) \\
\frac{13}{11} & =\frac{13}{11}
\end{aligned}
$$

Not all equations we encounter have unique solutions. Consider the equation:

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

To isolate the variable, we add $-5 x$ to each side of the equation:

$$
\begin{aligned}
5 x-3 & =5 x+2 \\
5 x+(-5 x)-3 & =5 x+(-5 x)+2 \\
-3 & =2
\end{aligned}
$$

But note this equation is false. Recall that solutions are values of the variables which result in a true statement, and thus there is no solution to this equation. Suppose the equation to solve is:

$$
4 x+6=2(2 x+3)
$$

Using the distributive property and solving the equation:

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

Again note that the variable dropped out of the equation, but this time the equation is true. Thus any value for the variable results in a true statement, so we say any number is a solution to this equation.

Example 4 Solve each equation. State that there is no solution or any number solution.
a. $\quad 2 x-3=2 x-3$
b. $3(4 r-5)=2(6 r-7)$
c. $\quad 12\left(\frac{1}{2} y-\frac{1}{3}\right)=6\left(y-\frac{2}{3}\right)$
d. $15\left(\frac{1}{3} v-\frac{3}{5}\right)=10\left(\frac{1}{2} v-1\right)$

Solution
a. Solving the equation:

$$
\begin{aligned}
2 x-3 & =2 x-3 \\
2 x+(-2 x)-3 & =2 x+(-2 x)-3 \\
-3 & =-3
\end{aligned}
$$

Since this statement is true for any value of $x$, any number is a solution.
b. Using the distributive property and solving the equation:

$$
\begin{aligned}
3(4 r-5) & =2(6 r-7) \\
12 r-15 & =12 r-14 \\
12 r+(-12 r)-15 & =12 r+(-12 r)-14 \\
-15 & =-14
\end{aligned}
$$

Since this statement is false, there is no solution to this equation.
c. Using the distributive property and solving the equation:

$$
\begin{aligned}
12\left(\frac{1}{2} y-\frac{1}{3}\right) & =6\left(y-\frac{2}{3}\right) \\
12 \cdot \frac{1}{2} y-12 \cdot \frac{1}{3} & =6 y-6 \cdot \frac{2}{3} \\
6 y-4 & =6 y-4 \\
6 y+(-6 y)-4 & =6 y+(-6 y)-4 \\
-4 & =-4
\end{aligned}
$$

Since this statement is true for any value of $y$, any number is a solution.
d. Using the distributive property and solving the equation:

$$
\begin{aligned}
15\left(\frac{1}{3} v-\frac{3}{5}\right) & =10\left(\frac{1}{2} v-1\right) \\
15 \cdot \frac{1}{3} v-15 \cdot \frac{3}{5} & =10 \cdot \frac{1}{2} v-10 \cdot 1 \\
5 v-9 & =5 v-10 \\
5 v+(-5 v)-9 & =5 v+(-5 v)-10 \\
-9 & =-10
\end{aligned}
$$

Since this statement is false, there is no solution to this equation.

Example 5 Solve the following equations. State if there is no solution or any number solution. Include a check of your solution.
a. $\quad 5(x+1)-4(x-2)=-3$
b. $2(4 y-3)-2(3 y+1)=2(y-2)$
c. $-3(s+4)-4(s-3)=5(2 s+1)-4(3 s+1)$
d. $\frac{2}{3}(t+1)-\frac{1}{2}(t-2)=-\frac{1}{2}$

Solution
a. Applying the distributive property, then simplifying and solving the equation:

$$
\begin{aligned}
5(x+1)-4(x-2) & =-3 \\
5 x+5-4 x+8 & =-3 \\
x+13 & =-3 \\
x+13+(-13) & =-3+(-13) \\
x & =-16
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
5(-16+1)-4(-16-2) & =-3 \\
5(-15)-4(-18) & =-3 \\
-75+72 & =-3 \\
-3 & =-3
\end{aligned}
$$

b. Applying the distributive property, then simplifying and solving the equation:

$$
\begin{aligned}
2(4 y-3)-2(3 y+1) & =2(y-2) \\
8 y-6-6 y-2 & =2 y-4 \\
2 y-8 & =2 y-4 \\
2 y+(-2 y)-8 & =2 y+(-2 y)-4 \\
-8 & =-4
\end{aligned}
$$

Since this statement is false, there is no solution to the equation.
c. Applying the distributive property, then simplifying and solving the equation:

$$
\begin{aligned}
-3(s+4)-4(s-3) & =5(2 s+1)-4(3 s+1) \\
-3 s-12-4 s+12 & =10 s+5-12 s-4 \\
-7 s & =-2 s+1 \\
-7 s+2 s & =-2 s+2 s+1 \\
-5 s & =1 \\
-\frac{1}{5} \cdot(-5 s) & =-\frac{1}{5} \cdot 1 \\
s & =-\frac{1}{5}
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
-3\left(-\frac{1}{5}+4\right)-4\left(-\frac{1}{5}-3\right) & =5\left(2 \cdot\left(-\frac{1}{5}\right)+1\right)-4\left(3 \cdot\left(-\frac{1}{5}\right)+1\right) \\
-3\left(-\frac{1}{5}+4\right)-4\left(-\frac{1}{5}-3\right) & =5\left(-\frac{2}{5}+1\right)-4\left(-\frac{3}{5}+1\right) \\
-3\left(-\frac{1}{5}+\frac{20}{5}\right)-4\left(-\frac{1}{5}-\frac{15}{5}\right) & =5\left(-\frac{2}{5}+\frac{5}{5}\right)-4\left(-\frac{3}{5}+\frac{5}{5}\right) \\
-3\left(\frac{19}{5}\right)-4\left(-\frac{16}{5}\right) & =5\left(\frac{3}{5}\right)-4\left(\frac{2}{5}\right) \\
-\frac{57}{5}+\frac{64}{5} & =\frac{15}{5}-\frac{8}{5} \\
\frac{7}{5} & =\frac{7}{5}
\end{aligned}
$$

d. Applying the distributive property, then simplifying and solving the equation:

$$
\begin{aligned}
\frac{2}{3}(t+1)-\frac{1}{2}(t-2) & =-\frac{1}{2} \\
\frac{2}{3} t+\frac{2}{3}-\frac{1}{2} t+1 & =-\frac{1}{2} \\
12 \cdot\left(\frac{2}{3} t+\frac{2}{3}-\frac{1}{2} t+1\right) & =12 \cdot\left(-\frac{1}{2}\right) \\
12 \cdot \frac{2}{3} t+12 \cdot \frac{2}{3}-12 \cdot \frac{1}{2} t+12 \cdot 1 & =-6 \\
8 t+8-6 t+12 & =-6 \\
2 t+20 & =-6 \\
2 t & =-26 \\
\frac{1}{2} \cdot 2 t & =\frac{1}{2} \bullet(-26) \\
t & =-13
\end{aligned}
$$

Checking the solution:

$$
\begin{aligned}
\frac{2}{3}(-13+1)-\frac{1}{2}(-13-2) & =-\frac{1}{2} \\
\frac{2}{3}(-12)-\frac{1}{2}(-15) & =-\frac{1}{2} \\
-8+\frac{15}{2} & =-\frac{1}{2} \\
-\frac{16}{2}+\frac{15}{2} & =-\frac{1}{2} \\
-\frac{1}{2} & =-\frac{1}{2}
\end{aligned}
$$

In the next section we will consider applications of the algebraic equations we studied in these two sections. Be sure that you understand how to solve these equations through the exercises in this section.

## Exercise Set 4.4

Solve the following equations. State if there is no solution or any number solution. Include a check of your solution.

1. $4 x+5=3 x+8$
2. $8 x+6=7 x+9$
3. $5 x+7=6 x+11$
4. $7 x+5=8 x+13$
5. $4 y+8=2 y-6$
6. $5 y+9=3 y-5$
7. $7 y-6=3 y-18$
8. $5 y-7=7 y-1$
9. $4 a-11=7 a+4$
10. $5 a-9=8 a+6$
11. $-2 a+3=a-12$
12. $-5 a+2=-3 a-5$
13. $-6 b+1=-3 b-7$
14. $-7 b+2=-3 b-8$
15. $8 b-3=-3+8 b$
16. $2 b-5=4+2 b$
17. $-3 s-6=6-3 s$
18. $-4 s-9=-9-4 s$
19. $-6 s+5=8-3 s$
20. $-7 s+12=15-5 s$
21. $4 t+5=6 t-17$
22. $7 t-8=12 t+12$
23. $-3 t+7=5 t-13$
24. $-t+6=4 t-12$

Solve each equation by first eliminating fractions and/or decimals. Include a check of your solution.
25. $\frac{1}{3} x+\frac{1}{4}=x-\frac{1}{2}$
26. $\frac{2}{3} x-\frac{1}{2}=x-\frac{3}{4}$
27. $\frac{1}{6} y+\frac{2}{3}=y-\frac{1}{3}$
28. $\frac{3}{4} y+\frac{1}{2}=y-\frac{1}{4}$
29. $\frac{1}{5} s+\frac{1}{2}=\frac{3}{5} s-\frac{1}{4}$
30. $\frac{3}{10} s+\frac{3}{4}=\frac{2}{5} s-\frac{1}{2}$
31. $\frac{1}{2} t+\frac{1}{3}=\frac{1}{6} t-\frac{3}{4}$
32. $\frac{1}{4} t+\frac{5}{8}=\frac{1}{2} t-\frac{1}{8}$
33. $\frac{5}{12} a-\frac{2}{3}=\frac{3}{4} a+\frac{1}{2}$
34. $\frac{5}{6} a+\frac{3}{4}=\frac{1}{2} a-\frac{1}{3}$
35. $3.5 b-1.5=3.3 b-2.1$
37. $-2.1 r-3.4=-1.9 r-2.5$
36. $2.8 b-1.9=2.5 b-1$
39. $500+0.1 t=1200$
38. $-1.7 r-4.7=-2.1 r-5.8$
40. $1200+0.08 t=2000$

Solve the following equations. State if there is no solution or any number solution. Include a check of your solution.
41. $5(x+3)=3(2 x-3)$
42. $7(x-2)=3(2 x-5)$
43. $9(y-1)=2(4 y-3)$
44. $11(y-2)=4(3 y-5)$
45. $\frac{1}{2}(a-2)=\frac{1}{3}(a-5)$
46. $\frac{3}{4}(2 a-1)=\frac{2}{3}(2 a-3)$
47. $\frac{5}{8}(3 b-2)=\frac{3}{4}(b-3)$
48. $\frac{5}{6}(2 b-3)=\frac{2}{3}(2 b-5)$
49. $-\frac{5}{6}(s-2)=-\frac{2}{3}(4 s-1)$
50. $-\frac{1}{2}(3 s-1)=-\frac{3}{4}(6 s-5)$
51. $6(2 t-5)=3(4 t-10)$
52. $5(4 t-3)=2(10 t-7)$
53. $-4(3 u-4)=-3(4 u-6)$
54. $-3(2 u-4)=-2(3 u-6)$
55. $0.3(2 v-1)=0.4(2 v-3)$
56. $-0.4(2 v+7)=0.2(v-5)$
57. $4(2.3 w-1.6)=3(3.1 w-2.2)$
58. $5(1.5 w-2.1)=4(1.9 w-2.5)$
59. $7(x+2)-6(x+3)=-9$
60. $12(x-3)-11(x-4)=-8$
61. $9(r-2)-11(r+1)=-21$
62. $5(r-4)-8(r-3)=-8$
63. $3(4 y-2)-4(3 y-2)=-5$
64. $5(4 y-3)-2(10 y-6)=-3$
65. $-3(2 a-1)+2(4 a-3)=-2(3 a-2)$
66. $-4(2 a-3)+3(3 a-1)=-2(a-3)$
67. $-4(5 b-3)+3(2 b-1)=-5(3 b-4)$
68. $-3(2 b-5)+2(4 b-3)=-2(2 b-5)$
69. $\frac{1}{3}(v+1)-\frac{1}{6}(v-1)=-\frac{1}{2}$
70. $-\frac{3}{4}(v-2)-\frac{1}{3}(v+3)=-\frac{2}{3}$
71. $-\frac{5}{6}(s-2)-\frac{1}{2}(s+1)=-\frac{4}{3}$
72. $-\frac{1}{6}(s-1)-\frac{1}{3}(s+2)=-\frac{1}{2}$
73. $-2(g+3)-5(g-2)=4(3 g-2)-3(2 g-1)$
74. $-3(p+4)-4(p-1)=3(4 p-5)-5(3 p-4)$
75. $-5(2 x+3)-4(3 x-2)=5(2 x-1)-4(3 x-1)$
76. $-3(4 y-1)-3(2 y-3)=-4(2 y-3)-3(2 y-1)$

