Module 7 Lesson 6: Solving Problems with Linear Systems
Are You Ready? Possible Solutions

1. a. Let $s =$ the cost in dollars of a shirt, and let $p =$ the cost of a pair of pants. The information can be represented by the following system of equations:

$$3s + p = 195$$
$$2s + 2p = 230$$

   b. Let $p =$ the part of the investment (in dollars) at the lower interest rate and $q =$ the part of the investment (in dollars) at the higher interest rate. This yields the following system:

$$p + q = 1000$$
$$0.05p + 0.08q = 62$$

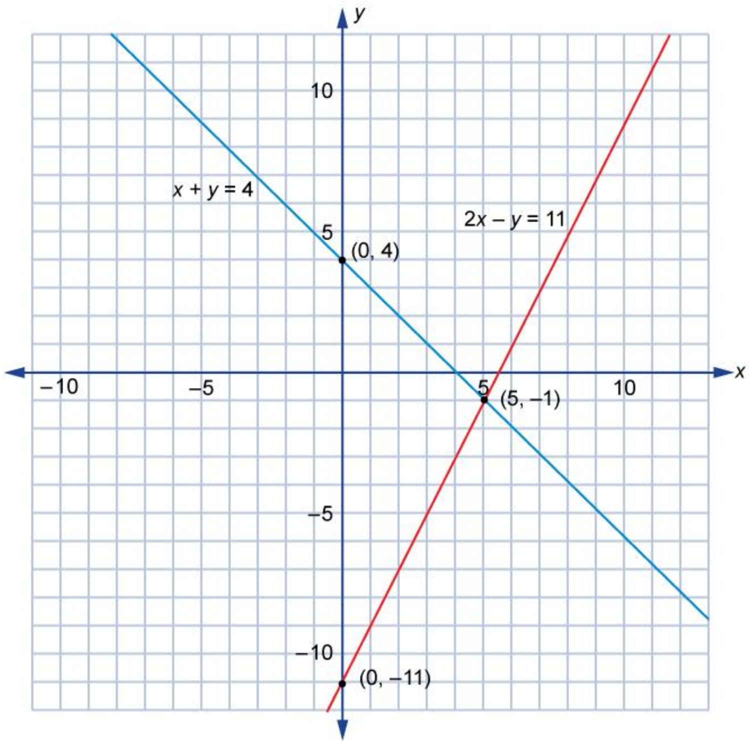
   c. Let $n =$ the larger number and $m =$ the smaller one. Then the associated system of equations is as follows:

$$n + m = 15$$
$$n - m = 35$$

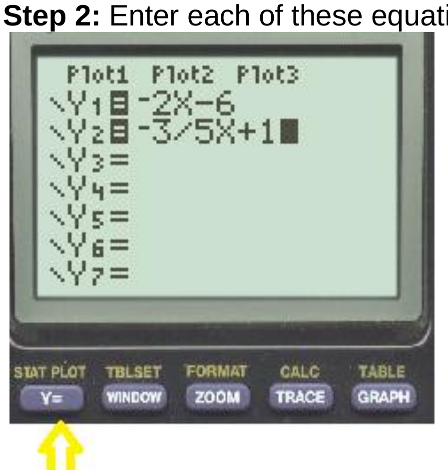
2. a. Graph the lines by first changing them to slope intercept form.
2x – y = 11
-y = -2x + 11
y = 2x – 11
To plot this do the following:
1. Plot the y intercept at (0, -11) on the y axis.
2. From this point use the slope of 2, to go up 2 and right 1 or down 2 and left 1.
3. Draw the line.

x + y = 4
y = -x + 4
To plot this do the following:
1. Plot the y intercept at (0, 4) on the y axis.
2. From this point use the slope of -1, to go down 1 and right 1 or up 1 and left 1.
3. Draw the line.

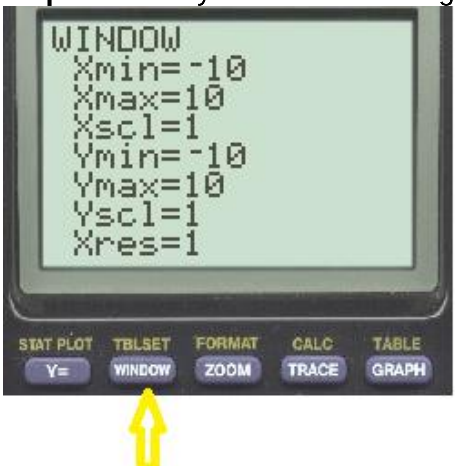
The two lines representing the equations of the system go through the point (5, −1). Therefore, (5, −1) is the solution to the system.



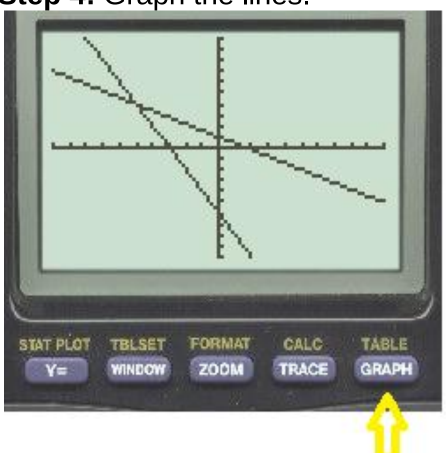
b. **Step 1:** Change the equations to slope intercept form
$2x + y = -6 \rightarrow y = -2x - 6$
$3x + 5y = 5 \rightarrow 5y = -3x + 5 \rightarrow y = -3/5x + 1$
Step 2: Enter each of these equations in y1 and y2 in your calculator.



Step 3: Check your window settings.

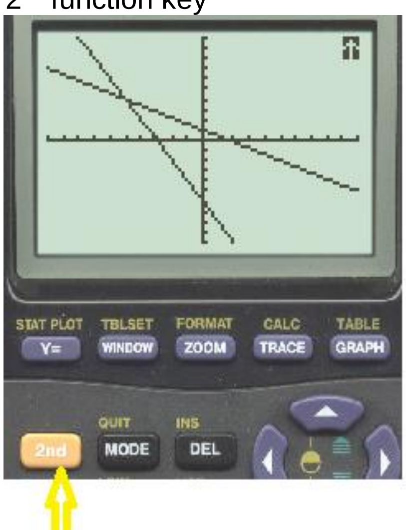


Step 4: Graph the lines.



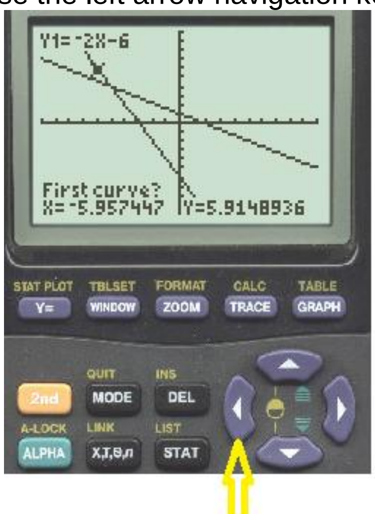
Step 5: Use the intersect feature on your calculator using the process shown below.

2nd function key

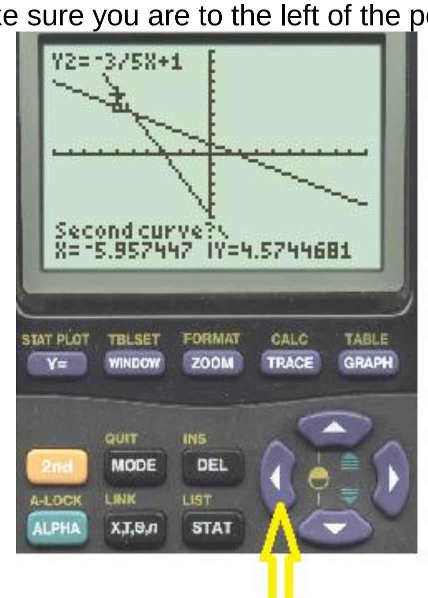


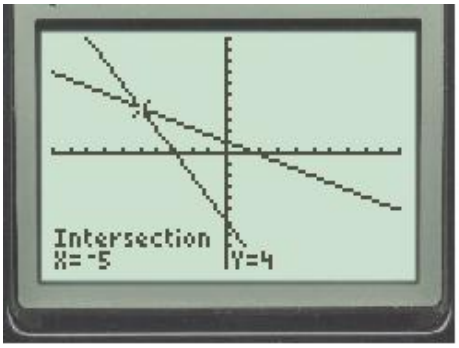
choose option 5: intersect

Use the left arrow navigation key to go to the left of the point on one curve. Hit enter.



Make sure you are to the left of the point of intersection on the second curve. Hit enter twice.





The intersection of the two lines representing the equations of the system is the point $(-5, 4)$. Therefore, $(-5, 4)$ is the solution to the system.

3. a. $2x+y=-6$ $\leftarrow$ Equation 1

$3x+5y=5$ $\leftarrow$ Equation 2

Isolate *y* in Equation 1.

$$2x+y=-6$$
$$y=-2x-6$$

Substitute the expression for *y* into Equation 2 and solve for *x*.

$$3x+5y=5$$
$$3x+5\ \ -2x-6\ \ =5$$
$$3x-10x-30=5$$
$$-7x-30=5$$
$$-7x=35$$
$$\frac{-7x}{-7}=\frac{35}{-7}$$
$$x=-5$$

Solve for *y* by subbing x = -5 into equation 1.

$$2x+y=-6$$
$$2\ \ -5\ \ +y=-6$$
$$-10+y=-6$$
$$y=4$$

Verify in equation 2

3x + 5y = 5

3(-5) + 5(4) = 5

-15 + 20 = 5

5= 5

The solution to the system is $(-5, 4)$.

b. $3x + 2y = -5$ ← Equation 1

$x - 6y = -5$ ← Equation 2

Isolate *x* in Equation 2.

$$x - 6y = -5$$
$$x = 6y - 5$$

Substitute the expression for *x* into Equation 1 and solve for *y*.

$$3x + 2y = -5$$
$$3\ \ 6y - 5\ \ + 2y = -5$$
$$18y - 15 + 2y = -5$$
$$20y - 15 = -5$$
$$20y = 10$$
$$\frac{20y}{20} = \frac{10}{20}$$
$$y = \frac{1}{2}$$

Solve for *x* by subbing in y = ½ into equation 2

$$x - 6y = -5$$
$$x - 6\left(\frac{1}{2}\right) = -5$$
$$x - 3 = -5$$
$$x = -2$$

Verify in equation 1

3x + 2y = -5

3(-2) + 2(1/2) = -5

-6 + 1 = -5

-5 = -5

The solution to the system is $-2,\ \frac{1}{2}$.

c. Multiply Equation 1 by 2.

$$2\ \ 5x + 2y = 23 \quad \rightarrow \quad 10x + 4y = 46 \quad \leftarrow \text{Equation 1}$$
$$3x - 4y = 19 \quad \rightarrow \quad 3x - 4y = 19 \quad \leftarrow \text{Equation 2}$$

Now add Equation 1 and Equation 2 to eliminate *y*.

$$\begin{array}{r} 10x + 4y = 46 \\ \underline{+\ (\ 3x - 4y = 19)} \\ 13x \qquad = 65 \end{array}$$
$$\frac{13x}{13} = \frac{65}{13}$$
$$x = 5$$

Solve for *y* by subbing x = 5 into equation 1

$$
\begin{aligned}
5x + 2y &= 23 \\
5\ \ 5\ \ + 2y &= 23 \\
25 + 2y &= 23 \\
2y &= -2 \\
\frac{2y}{2} &= \frac{-2}{2} \\
y &= -1
\end{aligned}
$$

Verify in equation 2
3x – 4y = 19
3(5) – 4(-1) = 19
15 + 4 = 19
19 = 19

The solution is (5, -1).

d. Multiply Equation 1 by 2 and Equation 2 by 3.

$$
\begin{aligned}
&2\ \ 3x + 4y = 27 &&\rightarrow && 6x + 8y = 54 && \leftarrow \text{Equation 1} \\
&3\ \ 2x - 5y = -5 &&\rightarrow && 6x - 15y = -15 && \leftarrow \text{Equation 2}
\end{aligned}
$$

Subtract Equation 2 from Equation 1 to eliminate *x*.

$$
\begin{array}{r}
6x + \ \ 8y = \ \ \ 54 \\
\underline{-\ (6x - 15y = -15)} \\
23y = 69
\end{array}
$$

$$
\begin{aligned}
\frac{23y}{23} &= \frac{69}{23} \\
y &= 3
\end{aligned}
$$

Solve for *x* by subbing y = 3 into equation 2.

$$
\begin{aligned}
2x - 5y &= -5 \\
2x - 5\ \ 3\ \ &= -5 \\
2x - 15 &= -5 \\
2x &= 10 \\
\frac{2x}{2} &= \frac{10}{2} \\
x &= 5
\end{aligned}
$$

Verify in equation 1
3x + 4y = 27
3(5) + 4(3) = 27
15 + 12 = 27
27 = 27
The solution is (5, 3).

4. a. $x+2y=10$ $\leftarrow$ Equation 1

$$2y=-x+10$$
$$y=-\frac{1}{2}x+5$$

$-2x-4y=20$ $\leftarrow$ Equation 2

$$-4y=2x+20$$
$$y=-\frac{1}{2}x-10$$

Since the *m*-values are equal and the *b*-values are different, the lines are parallel and distinct. Therefore, the system does not have a solution.

b. $2x-3y=5$ $\leftarrow$ Equation 1

$$-3y=-2x+5$$
$$y=\frac{2}{3}x-\frac{5}{3}$$

$6x+9y=15$ $\leftarrow$ Equation 2

$$9y=-6x+15$$
$$y=-\frac{2}{3}x+\frac{5}{3}$$

Since the *m*-values are different, the system has one solution.

c. $3x+6y=-9$ $\leftarrow$ Equation 1

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

$2x+4y=-6$ $\leftarrow$ Equation 2

$$4y=-2x-6$$
$$y=\frac{1}{2}x-\frac{3}{2}$$

Since both *m*-values and both *b*-values are equal, the system of equations has an infinite number of solutions.