

2.2 Linear Inequalities

In Problem 2.1, you used graphic and symbolic methods to analyze a **system of linear equations**. The problem conditions could be expressed as two equations relating security costs and the number of days for the business contract. The coordinates of the intersection point of the graphs satisfied both equations in the system. This point is the *solution* of the system.

Getting Ready for Problem 2.2

The cost equations for the two security companies are a system of linear equations:

$$\begin{aligned} c &= 3,975 + 6d && \text{(Super Locks)} \\ \text{and } c &= 995 + 17.95d && \text{(Fail Safe)} \end{aligned}$$

In previous units, you learned some methods to solve this linear system to find the number of days for which the costs are the same for both companies. Here is one possible solution method:

$$3,975 + 6d = 995 + 17.95d \quad (1)$$

$$2,980 = 11.95d \quad (2)$$

$$249 \approx d \quad (3)$$

- Give a reason for each step in the solution.
- What is the overall strategy that guides the solution process?
- What does the statement $d \approx 249$ tell you?
- How can the solution to this system help you answer this question:
For what numbers of days will Super Locks cost less than Fail Safe?
- What does your answer to the previous question tell you about solutions to the inequality $3,975 + 6d < 995 + 17.95d$?

It is fairly easy to find some solutions to an inequality. However, sometimes it is useful to find all the solutions by solving the inequality symbolically. The following problems will help you develop strategies for solving inequalities.

Problem 2.2 Linear Inequalities

- A. For each instruction in parts (1)–(6), start with $q < r$. Tell whether performing the operation on $q < r$ will give an inequality that is still true. If so, explain why. If not, give specific examples to show why the resulting inequality is false.

1. Add 23 to both sides. T

2. Subtract 35 from both sides. T

3. Multiply both sides by 14. T

4. Multiply both sides by -6 . F ex $4 < 5 \Rightarrow -24 > -30$

5. Divide both sides by 5. T

6. Divide both sides by -3 . F ex $2 < 3 \Rightarrow -\frac{2}{3} > -1$

- B. What do your results from Question A suggest about how working with inequalities is similar to and different from working with equations?

- C. Solve these equations and inequalities.

1. $3x + 12 = 5x - 4$

2. $3w + 12 < 5w - 4$

3. $q - 5 = 6q + 10$

4. $r - 5 > 6r + 10$

$$2. \quad 3w + 12 < 5w - 4$$

$$\begin{array}{r} -3w \quad -3w \\ \hline \end{array}$$

$$-2w + 12 < -4$$

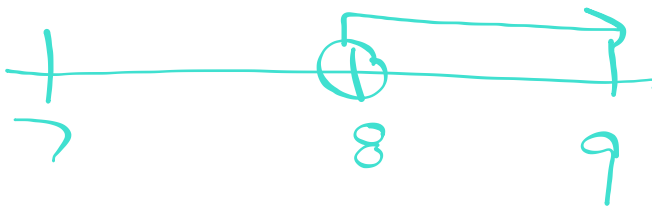
$$\begin{array}{r} -12 \quad -12 \\ \hline \end{array}$$

$$-2w < -16$$

$$\begin{array}{r} \hline -2 \quad -2 \end{array}$$

divide by a negative so flip the symbol

$$w > 8$$



$$4. r - 5 > 6r + 10$$

$$\begin{array}{r} -6r \quad 6r \\ \hline \end{array}$$

$$-5r - 5 > 10$$

$$\begin{array}{r} +5 \quad +5 \\ \hline \end{array}$$

$$-5r > 15$$

$$\begin{array}{r} \underline{-5} \quad \underline{-5} \\ \hline \end{array}$$

$$\begin{array}{r} \hline r < -3 \end{array}$$

$$\begin{array}{c} \leftarrow \\ + \quad - \quad + \\ -4 \quad -3 \quad -2 \end{array}$$

divide by a negative so flip the symbol

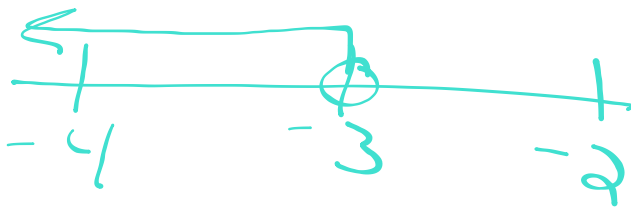
$$4. r - 5 > 6r + 10$$

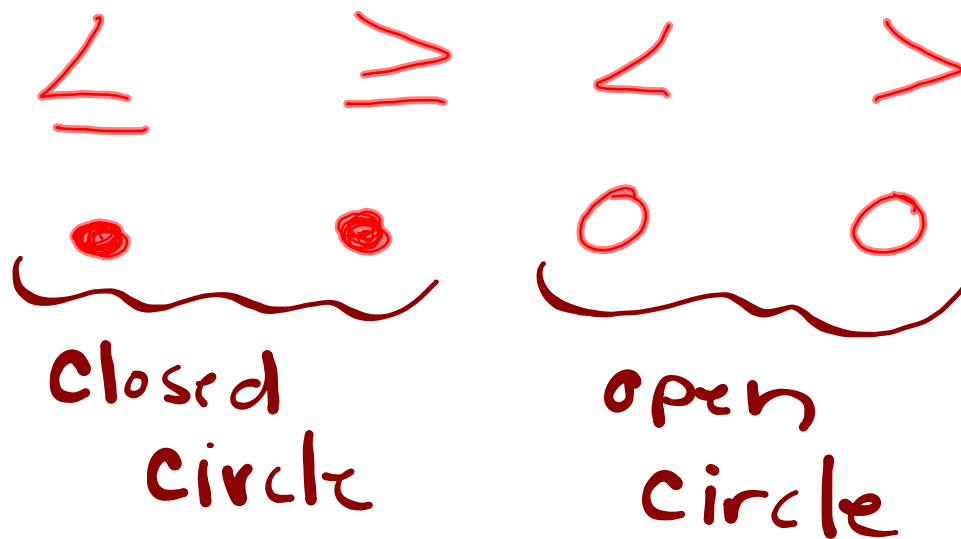
$$\begin{array}{r} -10 \quad -10 \\ \hline r - 5 > 6r + 10 \end{array}$$

$$\begin{array}{r} r - 15 > 6r \\ -r \quad -r \\ \hline \end{array}$$

$$\begin{array}{r} -15 > 5r \\ \hline \end{array}$$

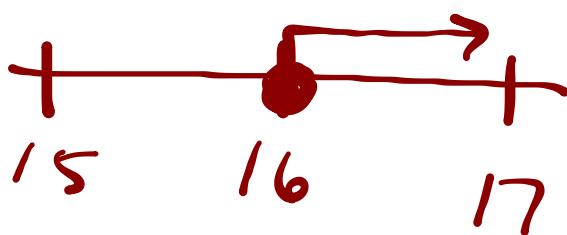
$$\begin{array}{r} -3 > r \end{array}$$





ex.

$$x \geq 16$$



$$x < 16$$



$$\begin{array}{rcl}
 2. & 3w + 12 < 5w - 4 \\
 -5w & -5w & \\
 \hline
 -2w + 12 < -4 & & \\
 -12 & -12 & \\
 \hline
 -2w < -16 & & \\
 \hline
 -2 & -2 & \text{divide by a negative so flip the symbol} \\
 \hline
 w > 8 & &
 \end{array}$$

$$\text{or } 8 < w$$

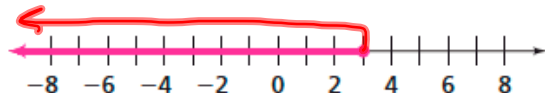
2.3 Solving Linear Inequalities

Many practical problems require solving linear inequalities. You can reason about inequalities, such as $2x - 4 < 5$ or $2x - 4 > -0.5x + 1$, using both symbolic and graphic methods. Solutions to inequalities with one variable are generally given in the form $x < a$, $x > a$, $x \leq a$, or $x \geq a$.

Getting Ready for Problem 2.3

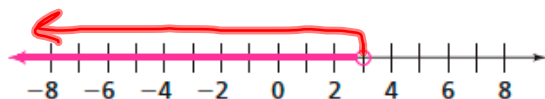
- What are some values that satisfy the inequality $3x + 4 \leq 13$?
- Describe all the solutions of the inequality $3x + 4 \leq 13$.

All the solutions of $3x + 4 \leq 13$ can be displayed in a number-line graph. This graph represents $x \leq 3$, all x -values less than or equal to 3.



- Explain why the solutions of $3x + 4 < 13$ do *not* include the value 3.

The number-line graph below represents the solutions of $3x + 4 < 13$. It shows $x < 3$, all x -values strictly less than 3. The open circle shows that 3 is not a solution.



- Make a number-line graph showing the solutions of $2x - 4 < 5$.
- Explain in words what the graph tells about the solutions.

Problem 2.3 Solving Linear Inequalities

A. Use symbolic reasoning to solve each inequality. Then make a number-line graph of the solutions. Be prepared to justify your solution steps and to explain your graphs.

1. $3x + 17 < 47$

2. $43 < 8x - 9$

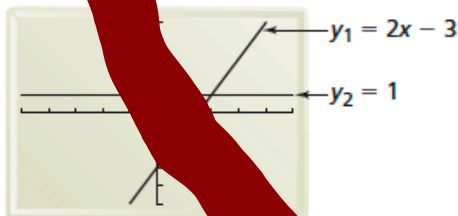
3. $-6x + 9 < 25$

4. $14x - 23 < 5x + 13$

5. $18 < -4x + 2$

6. $3,975 + 6d < 995 + 17.95d$

B. Luisa wants to use her graphing calculator to solve $2x - 3 \leq 1$. She graphs the linear function $y_1 = 2x - 3$ and $y_2 = 1$. She uses an x - and y -axis scale of 1.



1. Luisa knows that the solution for $2x - 3 = 1$ is $x = 2$. How does this relate to the graphs of the lines? What did she draw?
2. How do the graphs show that the solution of $2x - 3 \leq 1$ is $x \leq 2$?
3. How can you use the graph to find the solution of $2x - 3 > 1$? What is the solution?
4. For one of the inequalities in Question A, sketch a graph on your graphing calculator to find the solution. Check that your solution agrees with the one you found by using symbolic reasoning.

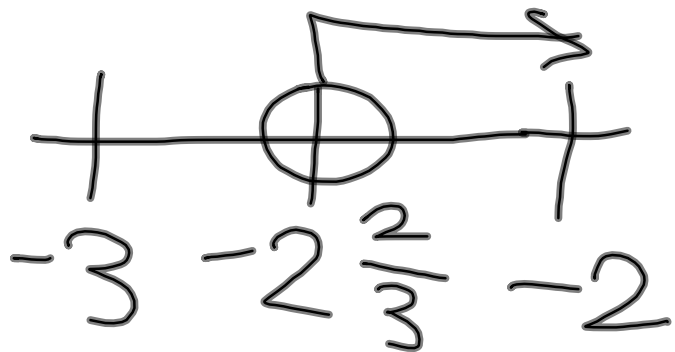
3. $-6x + 9 < 25$

$$\frac{-9 \quad -9}{-6x < 16}$$

$$\frac{\div -6 \quad \div -6}{x > -\frac{16}{6}}$$

$$x > -\frac{16}{6}$$

$$x > -2\frac{2}{3}$$



4. $14x - 23 < 5x + 13$

$$\begin{array}{r} +23 \quad +23 \\ \hline \end{array}$$

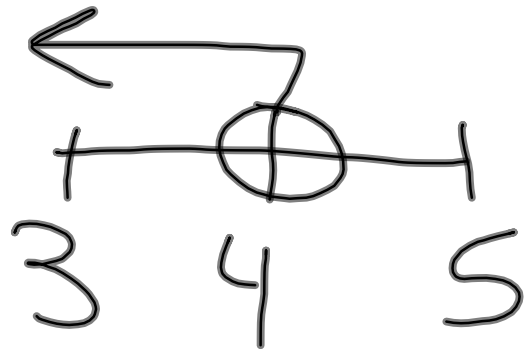
$$14x < 5x + 36$$

$$\begin{array}{r} -5x \quad -5x \\ \hline \end{array}$$

$$9x < 36$$

$$\begin{array}{r} \div 9 \quad \div 9 \\ \hline \end{array}$$

$$x < 4$$



5. $18 < -4x + 2$

$$\begin{array}{r} -2 \quad -2 \\ \hline \end{array}$$

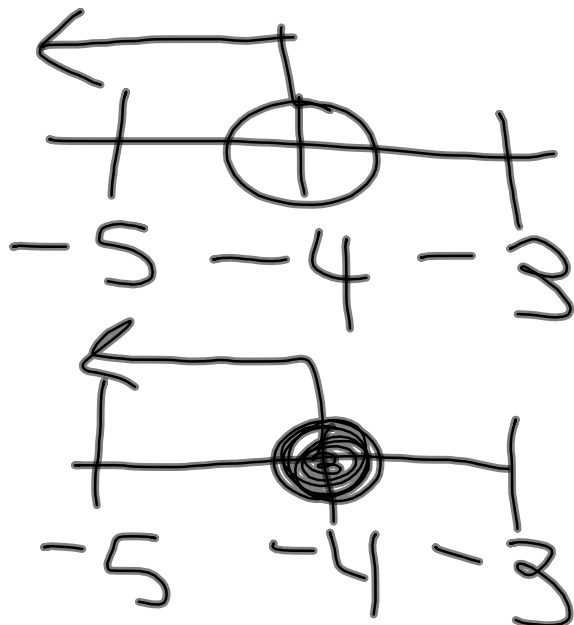
$$16 < -4x$$

$$\begin{array}{r} \div -4 \quad \div -4 \\ \hline \end{array}$$

$$-4 > x$$

$$x < -4$$

$$x \leq -4$$

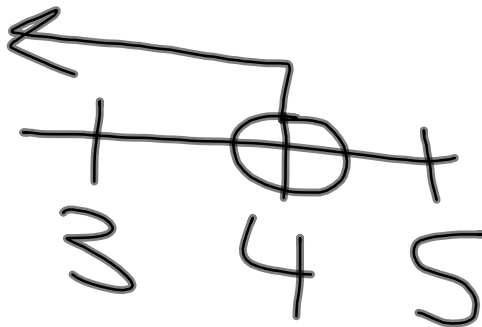


4. $14x - 23 < 5x + 13$

$$\begin{array}{r} +23 \quad +23 \\ \hline 14x < 5x + 36 \\ -5x \quad -5x \\ \hline \end{array}$$

$$\begin{array}{r} 9x < 36 \\ \div 9 \quad \div 9 \\ \hline \end{array}$$

$$x < 4$$



Investigation 3

Equations With Two or More Variables

You have done a lot of work with relationships involving two related variables. However, many real-world relationships involve three or more variables. For example, consider this situation:

The eighth-graders are selling T-shirts and caps to raise money for their end-of-year party. They earn a profit of \$5 per shirt and \$10 per cap.

This situation involves three variables: the *number of T-shirts sold*, the *number of caps sold*, and the *profit*. The profit for the fundraiser depends on the number of caps and the number of T-shirts sold.

Getting Ready for Problem 3.1

- What equation shows how the profit p is related to the number of shirts sold s and the number of caps sold c ?
- Find the profit if the students sell
 - 30 shirts and 50 caps
 - 15 shirts and 10 caps
 - 12 shirts and 20 caps
- What do you think it means to *solve* an equation with three variables?
- What ideas do you have for finding solutions to the equation?



3.2 Connecting $y = mx + b$ and $ax + by = c$

There are two common forms of a linear equation.

- When the values of one variable depend on those of another, it is most natural to express the relationship as $y = mx + b$. Most of the linear equations you have seen have been in this slope-intercept form.
- When it is more natural to combine the values of two variables, the relationship can be expressed as $ax + by = c$. This is the standard form of a linear equation. The equations in Problem 3.1 were in standard form.

$$y = -\frac{2}{3}x + \frac{10}{3}$$

$$2x + 3y = 10$$

Getting Ready for Problem 3.2

It is easy to graph a linear equation of the form $y = mx + b$ on a calculator.

- Can you use a calculator to graph an equation of the form $ax + by = c$?
- Can you change an equation from $ax + by = c$ form to $y = mx + b$ form?
- How can rewriting the equation $600 = 5s + 10c$ (or $600 = 5x + 10y$) from Problem 3.1 in $y = mx + b$ form help you find solutions?

3.1 Many Ways to Reach a Goal

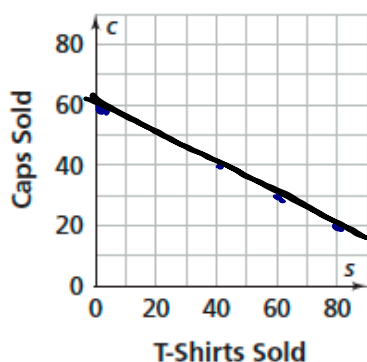
The equation relating p , s , and c represents every possible combination of T-shirts, caps, and profit values for the fundraiser. Suppose the class sets a profit goal of $P = \$600$. Finding combinations of T-shirt and cap sales that meet this goal requires solving an equation with only two variables, s and c .

Problem 3.1 Solving Equations With Two Variables

- A. Find five pairs of numbers for shirt and cap sales that will allow the students to make a \$600 profit exactly.

- B. 1. Each answer for Question A can be expressed as an ordered pair (s, c) . Plot these ordered pairs on a grid like the one below.

Fundraiser Sales



2. Is there a pattern in the points that suggests other solutions of the equation $600 = 5s + 10c$? Explain.

$$c = 60 - .5s$$

$$(s, c)$$

$$5s + 10c = 600$$

$$(60, 30), (100, 10), (80, 20),$$

$$(120, 0), (40, 40)$$

C. The equations in parts (1)–(4) are of the form $c = ax + by$ or $ax + by = c$. For each equation,

- find at least five solution pairs (x, y)
- plot the solutions
- find a pattern in the points and use the pattern to predict other solution pairs

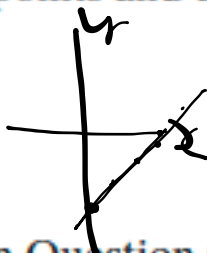
1. $5 = x - y$

x	y
0	-5
5	0

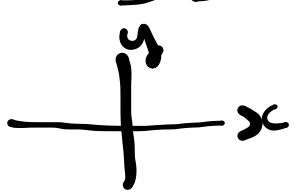
3. $2x + y = 3$

2. $10 = x + y$

4. $-3x + 2y = -4$



D. What does your work on Question C suggest about the graph of solutions for any equation of the form $ax + by = c$ or $c = ax + by$, where a , b , and c are fixed numbers?

$$3x + 5y = 60$$


$$\Rightarrow 5y = -3x + 60$$

$$\Rightarrow y = -\frac{3}{5}x + 12$$

x-int? $(20, 0)$

y-int? $(0, 12)$

slope? $-\frac{3}{5}$

$$y = a(b)^x$$

↙
y-int

↘
g.f or d.f.

ex $y = 16(2.4)^x$

$$y = 31(0.85)^x$$

$$y = 32(3.4)^x$$

start w/ \$1500
@ 8%/year

$$y = 1500(1.08)^x$$

Problem 3.2 Connecting $y = mx + b$ and $ax + by = c$

A. Four students want to write $12x + 3y = 9$ in equivalent $y = mx + b$ form. Here are their explanations:

Jared



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

Molly



$$\begin{aligned} 12x + 3y &= 9 \\ 3y &= 9 - 12x & (1) \\ y &= 3 - 12x & (2) \end{aligned}$$

Ali



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

Mia



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

1. Did each student get an equation equivalent to the original? If so, explain the reasoning for each step. If not, tell what errors the student made.

2. What does it mean for two equations to be equivalent?

B. Write each equation in $y = mx + b$ form.

1. $x - y = 4$
 $\Rightarrow y = x - 4$

2. $2x + y = 9$
 $\Rightarrow y = -2x + 9$

3. $8x + 4y = -12$
 $\Rightarrow y = -2x - 3$

4. $12 = 3x - 6y$

5. $x + y = 2.5$

6. $600 = 5x + 10y$

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

$\Rightarrow y = -x + 2.5$

$\Rightarrow y = -\frac{1}{5}x + 60$

C. Suppose you are given an equation in $ax + by = c$ form. How can you predict the slope, y-intercept, and x-intercept of its graph?

D. Write each equation in $ax + by = c$ form.

1. $y = 5 - 3x$
 $\Rightarrow 3x + y = 5$

2. $y = \frac{2}{3}x + \frac{1}{4}$
 $\Rightarrow \frac{2}{3}x + y = \frac{1}{4}$

3. $x = 2y - 3$
 $\Rightarrow x - 2y = -3$

4. $2x = y + \frac{1}{2}$

5. $y - 2 = \frac{1}{4}x + 1$

6. $3y + 3 = 6x - 15$

$\Rightarrow 2x - y = \frac{1}{2}$

$\Rightarrow -\frac{1}{4}x + y = 3$

$\Rightarrow -6x + 3y = -18$

C. Suppose you are given an equation in $ax + by = c$ form. How can you predict the slope, y-intercept, and x-intercept of its graph?

$$\begin{array}{r} ax + by = c \\ -ax \quad -ax \\ \hline \frac{by}{b} = \frac{-ax}{b} + \frac{c}{b} \\ \hline y = -\frac{a}{b}x + \frac{c}{b} \end{array}$$

Slope $\Rightarrow -\frac{a}{b}$

y-int $(0, \frac{c}{b})$

ex. $2x + 3y = 10$

x-int: $(, 0)$

$$\begin{array}{r} ax + by = c \\ ax + b(0) = c \end{array}$$

$$ax + 0 = c$$

$$\frac{ax}{a} = \frac{c}{a}$$

$$\begin{array}{r} x = \frac{c}{a} \\ \hline (\frac{c}{a}, 0) \end{array}$$

$$4. 12 = 3x - 6y$$

$$\begin{array}{r} +6y \quad +6y \\ \hline \end{array}$$

$$6y + 12 = 3x$$

$$\begin{array}{r} -12 \quad -12 \\ \hline \end{array}$$

$$\frac{6y}{6} = \frac{3x - 12}{6}$$

$$y = \frac{1}{2}x - 2$$

x	y	
0		y-intercept
	0	x-intercept

C. Suppose you are given an equation in $ax + by = c$ form. How can you predict the slope, y-intercept, and x-intercept of its graph?

$$\begin{array}{r} ax + by = c \\ -ax \quad -ax \\ \hline \frac{by}{b} = \frac{-ax}{b} + \frac{c}{b} \\ \hline y = -\frac{a}{b}x + \frac{c}{b} \end{array}$$

$$\text{slope} = -\frac{a}{b}$$

$$y\text{-int} = (0, \frac{c}{b})$$

$$x\text{-int } (, 0)$$

$$\begin{array}{r} ax + by = c \\ ax + b(0) = c \end{array}$$

$$ax + 0 = c$$

$$\frac{ax}{a} = \frac{c}{a}$$

$$x = \frac{c}{a}$$

$$(\frac{c}{a}, 0)$$

Write in standard form using integer coefficients

$$2. y = \frac{2}{3}x + \frac{1}{4}$$

$$\begin{array}{r} -\frac{2}{3}x - \frac{2}{3}x \\ \hline 12\left(-\frac{2}{3}x + y = \frac{1}{4}\right) 12 \\ \hline -8x + 12y = 3 \end{array}$$

On January 30 of this year, the first radio broadcast of *The Lone Ranger* was heard in the United States. The song played at the beginning of the program was the “William Tell Overture” from Rossini’s opera. The program started and ended with the phrase “Hi-yo, Silver!” Learn the year by solving this puzzle.

- The two-digit number formed by my tens and units digits is equal to $1! + 2! + 3! + 4!$.
- My hundreds digit is equal to the sum of the first three odd integers.
- The sum of all of my digits is the median of 22, 30, 9, 30, 16, 6, and 10.

What year am I?



Page 154: *The Lone Ranger* was first heard in 1933.

Thousands

Hundreds

Tens

Units

Yoda has a picture of Chuck Norris in his wallet.



3.3 Intersections of Lines

At a school band concert, Christopher and Celine sell memberships for the band's booster club. An adult membership costs \$10, and a student membership costs \$5.

At the end of the evening, the students had sold 50 memberships for a total of \$400. The club president wants to know how many of the new members are adults and how many are students.



Problem 3.3 Intersections of Lines

A. Let x stand for the number of \$10 adult memberships and y for the number of \$5 student memberships.

1. What equation relates x and y to the \$400 income? $400 = 10x + 5y$

2. Give two solutions for your equation from part (1). $(0, 80)$ & $(40, 0)$

3. What equation relates x and y to the total of 50 new members?

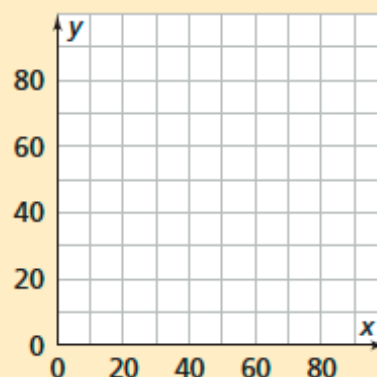
Are the solutions you found in part (2) also solutions of this equation? $50 = x + y$

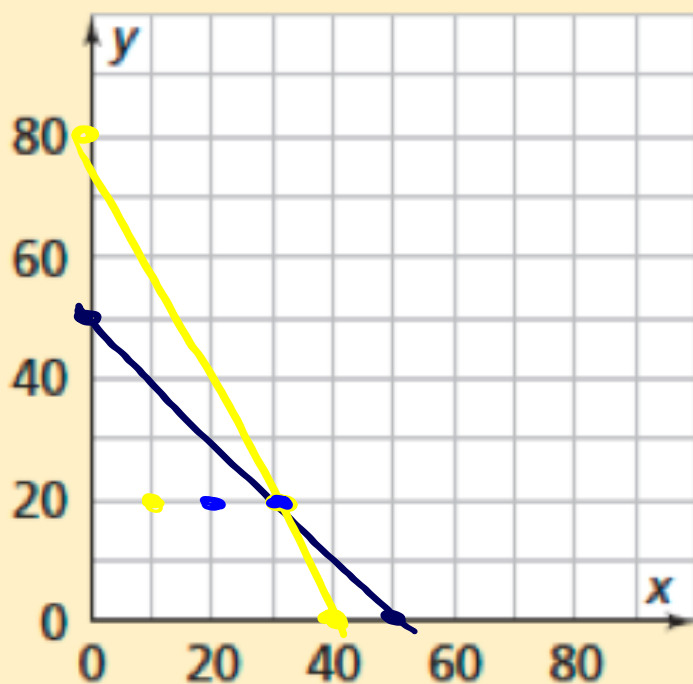
B. 1. Graph the two equations from Question A on a single coordinate grid like the one at the right.

2. Estimate the coordinates of the point where the graphs intersect. Explain what the coordinates tell you about the numbers of adult and student memberships sold.

3. Consider the graph of the equation that relates x and y to the \$400 income. Could a point that is *not* on this graph be a solution to the equation?

4. Could there be a common solution for both of your equations that is *not* shown on your graph?



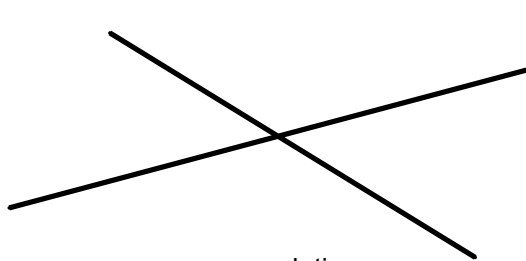


$$\begin{cases} 10x + 5y = 400 \\ x + y = 50 \end{cases}$$

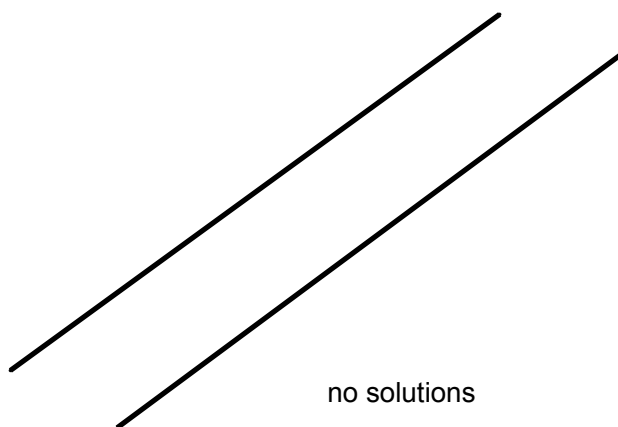
x	y
0	50
50	0

x	y
0	80
40	0

$(30, 20)$



one solution



no solutions

$$x - y = 50$$

$$2x - 2y = 100$$

infinite solutions (any point on line will work)

In Question A, you wrote a system of equations. One equation represents all (x, y) pairs that give a total income of \$400, and the other represents all (x, y) pairs that give a total of 50 memberships. The coordinates of the intersection point satisfy both equations, or conditions. These coordinates are the *solution to the system*.

Many real-life problems can be represented by systems of equations. In Question C, you'll practice solving such systems graphically.

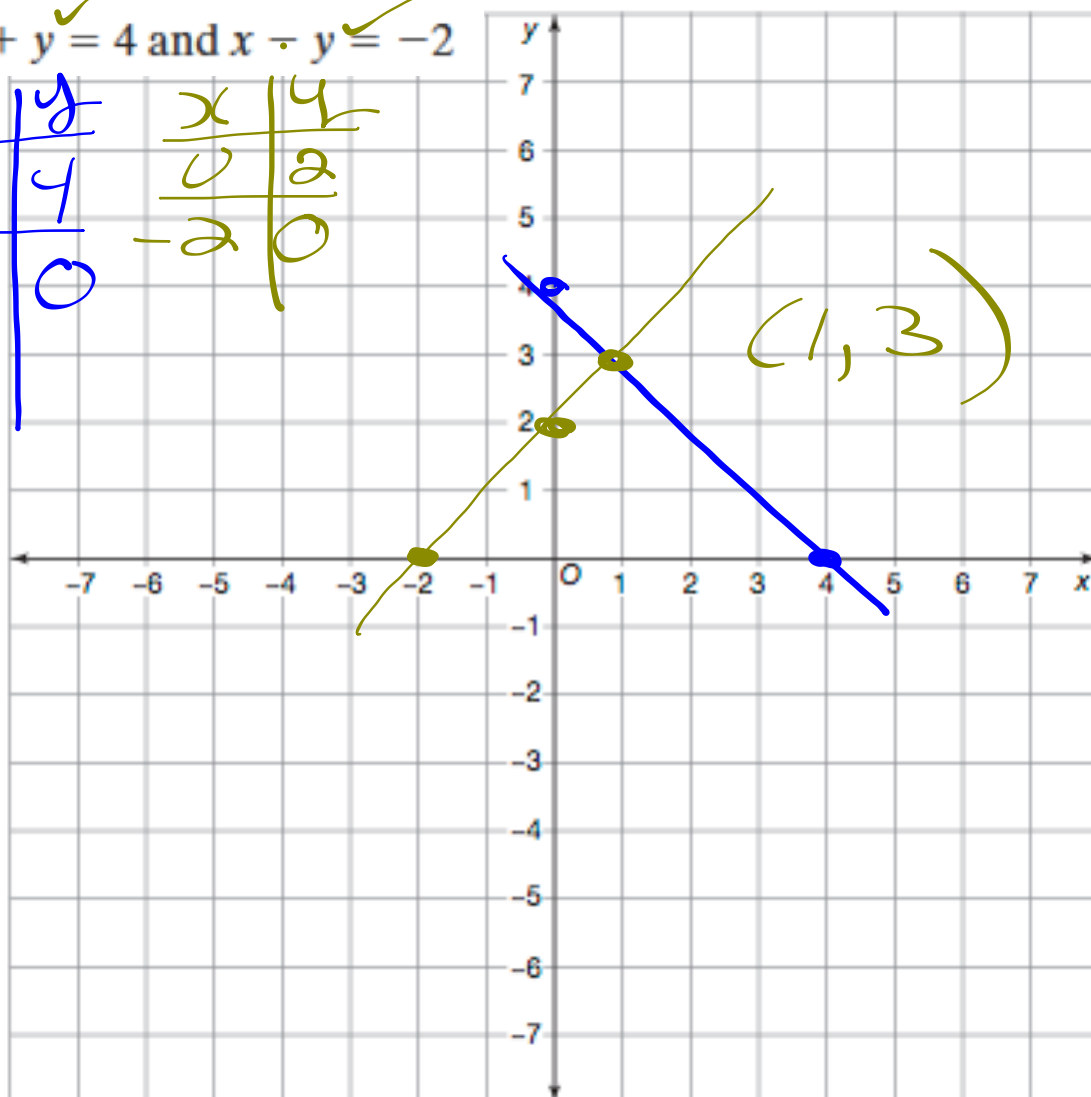
- C.** Use graphic methods to solve each system. In each case, substitute the solution values into the equations to see if your solution is exact or an estimate.

1. $x + y = 4$ and $x - y = -2$ $(1, 3)$
2. $2x + y = -1$ and $x - 2y = 7$ $(1, -3)$
3. $2x + y = 3$ and $-x + 2y = 6$ $(0, 3)$

1. $x + y = 4$ and $x - y = -2$

$$\begin{array}{r|l} x & y \\ \hline 0 & 4 \\ \hline 4 & 0 \end{array}$$

$$\begin{array}{r|l} x & y \\ \hline 0 & 2 \\ \hline -2 & 0 \end{array}$$



If $A = B$ and
 $A = C$,
then what can you conclude?

$$B = C$$



**GET
CURIOUS**



**NOT
FURIOUS**

ASK YOURSELF: What else can this mean?
How might this be a good thing in disguise?

notsalmon.com

On February 11 of this year (B.C.E.), the Japanese nation was founded when Emperor Jimmu ascended to the throne. The national holiday is called National Foundation Day, and ceremonies are held with the emperor, empress, and many other dignitaries attending. What is this historical year?

- The two-digit number formed by my hundreds and tens digits is equal to the sum of the first 11 counting numbers.
- The sum of all of my digits is equal to the value of x in this proportion: $\frac{x}{3} = \frac{x+4}{4}$.

What year am I?

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

$$4x = 3x + 12$$

$$x = 12$$

<u>6</u>	<u>6</u>	<u>0</u>
Hundreds	Tens	Units

156

Chuck Norris can travel a negative distance



$$ax + by = c$$

$$x\text{-int } (c/a, 0)$$

$$ax + b(0) = c$$

$$\Rightarrow ax = c$$

$$\Rightarrow x = c/a$$

$$y\text{-int } (0, c/b)$$

$$a(0) + by = c$$

$$by = c$$

$$\Rightarrow y = c/b$$

$$ax + by = c$$

$$\Rightarrow by = -ax + c$$

$$\Rightarrow y = -\frac{a}{b}x + \frac{c}{b}$$

Slope

4.1 The $y = mx + b$ Case

The equations for the flight paths can be used to calculate the nine intersection points shown on the graph.

Getting Ready for Problem 4.1

A table of equations for the flight paths is at the right.

To find the intersection of WC 19 and AA 29, you need to find the (x, y) pair that satisfies the system of linear equations below. (The bracket is a special notation used to indicate a system of equations.)

$$\begin{cases} y = 0.3x - 2 \\ y = 1.5x - 0.4 \end{cases}$$

Jeff writes the following to solve this system.

$$\begin{aligned} 0.3x - 2 &= 1.5x - 0.4 \\ -1.2x &= 1.6 \\ x &= \frac{1.6}{-1.2} \\ x &= -\frac{4}{3} \end{aligned}$$

Flight Paths

Airline/Flight	Equation
Apex Airlines Flight AA 29	$y = 1.5x - 0.4$
We-Care Air Flight WC 19	$y = 0.3x - 2$
Open Sky Airlines Flight OS 314	$y = 0.3x + 5$
Fly Away Airlines Flight FA 12	$y = -0.4x + 9.5$
Sky Bus Airlines Flight SB 5	$y = -2x + 14$

- Explain Jeff's reasoning.
- What does $x = -\frac{4}{3}$ tell you?
- How can you find the y -coordinate of the intersection point?

A. Write and solve systems to find the intersections of these flight plans.

1. WC 19 and SB 5

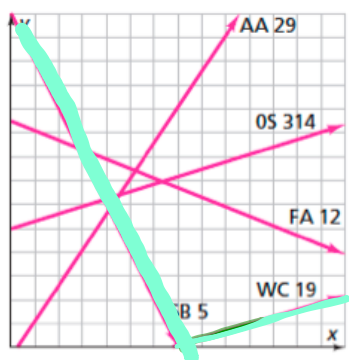
2. SB 5 and AA 29

3. SB 5 and FA 12

4. FA 12 and AA 29

Flight Paths

Airline/Flight	Equation
Apex Airlines Flight AA 29	$y = 1.5x - 0.4$
We-Care Air Flight WC 19	$y = 0.3x - 2$
Open Sky Airlines Flight OS 314	$y = 0.3x + 5$
Fly Away Airlines Flight FA 12	$y = -0.4x + 9.5$
Sky Bus Airlines Flight SB 5	$y = -2x + 14$



1. WC 19 and SB 5

$$\begin{cases} y = 0.3x - 2 \\ y = -2x + 14 \end{cases} \quad (6.96, 0.09)$$

1st

$$-2x + 14 = 0.3x - 2$$

$$\Rightarrow 14 = 2.3x - 2$$

$$\Rightarrow 16 = 2.3x$$

$$\Rightarrow 6.96 \approx x$$

2nd

$$y = -2x + 14$$

$$y = -2(6.96) + 14$$

$$y \approx 0.09$$

Problem 4.1 The $y = mx + b$ Case

A. Write and solve systems to find the intersections of these flight plans.

1. WC 19 and SB 5

2. SB 5 and AA 29

3. SB 5 and FA 12

4. FA 12 and AA 29



B. Study the work you did in Question A. Describe a strategy for solving any system of this form shown below.

$$\begin{cases} y = ax + b \\ y = cx + d \end{cases}$$

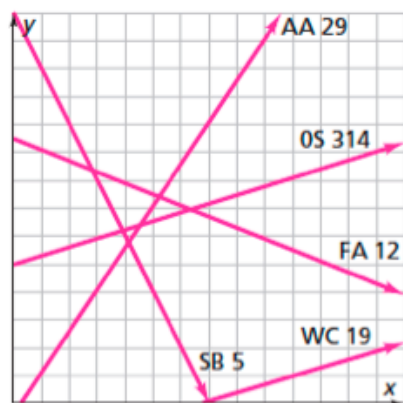
C. What could an air-traffic controller do if two flight plans intersect?

ACE Homework starts on page 59.

2. SB 5 and AA 29

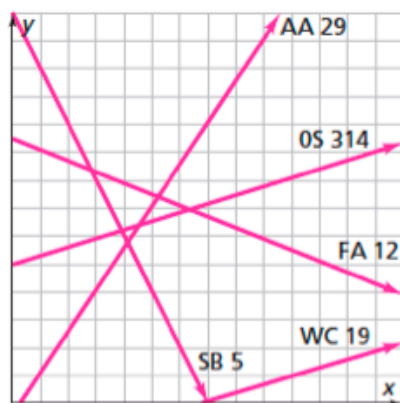
Flight Paths

Airline/Flight	Equation
Apex Airlines Flight AA 29	$y = 1.5x - 0.4$
We-Care Air Flight WC 19	$y = 0.3x - 2$
Open Sky Airlines Flight OS 314	$y = 0.3x + 5$
Fly Away Airlines Flight FA 12	$y = -0.4x + 9.5$
Sky Bus Airlines Flight SB 5	$y = -2x + 14$



3. SB 5 and FA 12**Flight Paths**

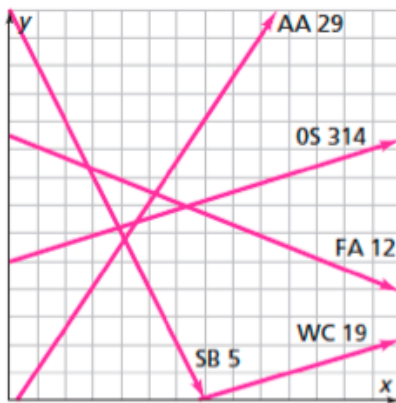
Airline/Flight	Equation
Apex Airlines Flight AA 29	$y = 1.5x - 0.4$
We-Care Air Flight WC 19	$y = 0.3x - 2$
Open Sky Airlines Flight OS 314	$y = 0.3x + 5$
Fly Away Airlines Flight FA 12	$y = -0.4x + 9.5$
Sky Bus Airlines Flight SB 5	$y = -2x + 14$



4. FA 12 and AA 29

Flight Paths

Airline/Flight	Equation
Apex Airlines Flight AA 29	$y = 1.5x - 0.4$
We-Care Air Flight WC 19	$y = 0.3x - 2$
Open Sky Airlines Flight OS 314	$y = 0.3x + 5$
Fly Away Airlines Flight FA 12	$y = -0.4x + 9.5$
Sky Bus Airlines Flight SB 5	$y = -2x + 14$



Problem 4.1 The $y = mx + b$ Case

A. Write and solve systems to find the intersections of these flight plans.

1. WC 19 and SB 5

2. SB 5 and AA 29

3. SB 5 and FA 12

4. FA 12 and AA 29

B. Study the work you did in Question A. Describe a strategy for solving any system of this form shown below.

$$\begin{cases} y = ax + b \\ y = cx + d \end{cases}$$

C. What could an air-traffic controller do if two flight plans intersect?

ACE Homework starts on page 59.

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1.) (6.96, 0.09) 2.) (4.11, 5.78)
3.) (2.81, 8.38) 4.) (5.21, 7.42)

$$\begin{cases} y = ax + b \\ y = cx + d \end{cases}$$

$$\begin{array}{r} ax + b = cx + d \\ -cx \quad -cx \\ \hline \end{array}$$

$$\begin{array}{r} ax - cx + b = d \\ -b \quad -b \\ \hline \end{array}$$

$$\begin{array}{r} ax - cx = d - b \\ x(a - c) = \frac{d - b}{a - c} \\ \hline \end{array}$$

$$x = \frac{d - b}{a - c}$$

→ now we can substitute in for x to find y !!