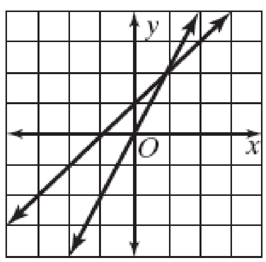
Systems of Linear Equations and Inequalities: Graphing

Vocabulary and Key Concepts

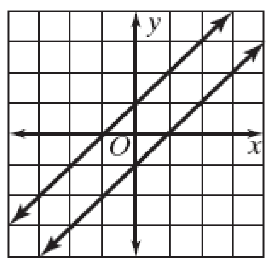
Numbers of Solutions of Systems of Linear Equations

different slopes



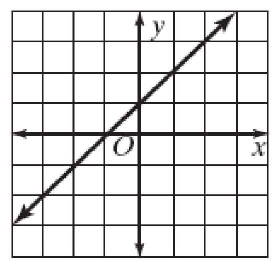
The lines ______ so there is ______ solution.

same slope
different *y*-intercepts

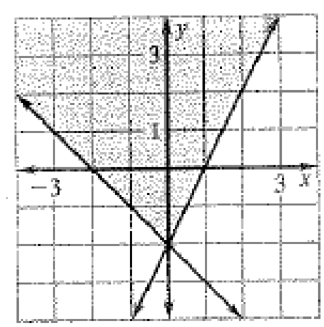


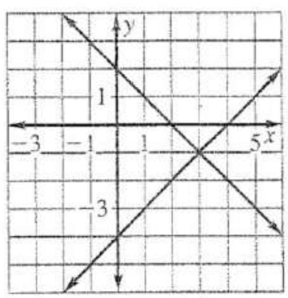
The lines ______ so there are ______ solutions.

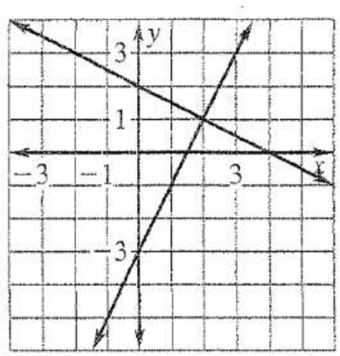
same slope
same *y*-intercept



The lines are ______ so there are ______ solutions.



Main Ideas	Details
Does the point satisfy the system	3x – 2y = 11 -x + 6y = 7 (5, 2) x + 3y = 15 4x + y = 6 (3, -6) The graph of the equations x + y =2 and x – y = 4 is shown.  1. What are the coordinates of the point of intersection? 2. Substitute the coordinates into each equation and describe what you see.

	The graph of the equations 2x - y = 3 and x + 2y = 4 is shown.  1. What are the coordinates of the point of intersection? 2. Substitute the coordinates into each equation and describe what you see.

Vocabulary:

A system of linear equations is ____

____

A solution of a system of linear equations is ______________________________________

____

Points of Intersection (POI) are the same thing as the solutions of a system.

No solution means ____

____

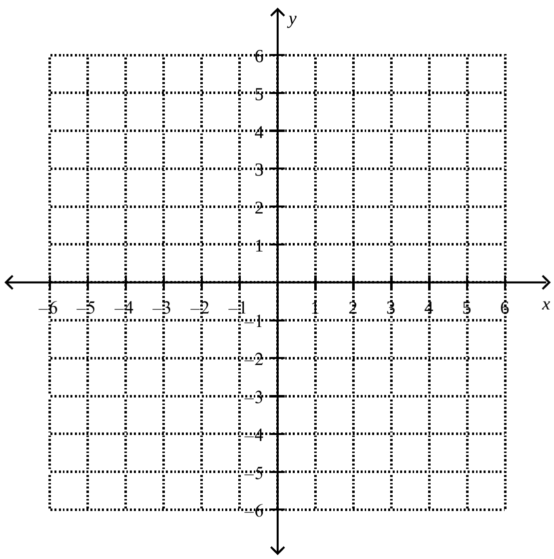
A system of equations has infinitely many solutions when __________________________

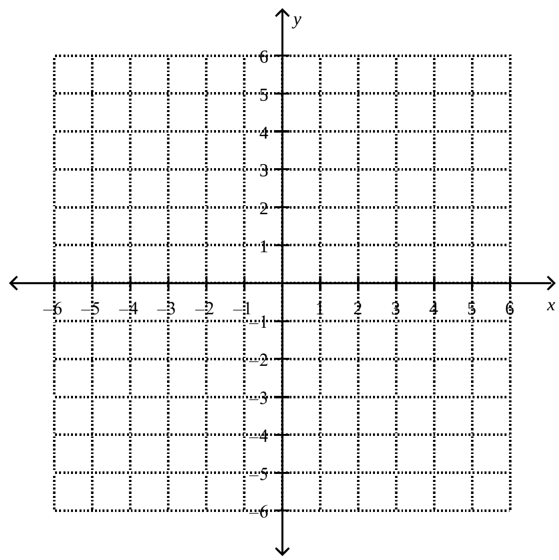
____

Solve the system graphically. Confirm the solution algebraically.

Ex. 3) $\begin{cases} 2x - 6 = y \\ 3 - x = y \end{cases}$

Try-It) $\begin{cases} -\dfrac{3}{2}x + 2 = y \\ -2 + \dfrac{1}{2}x = y \end{cases}$

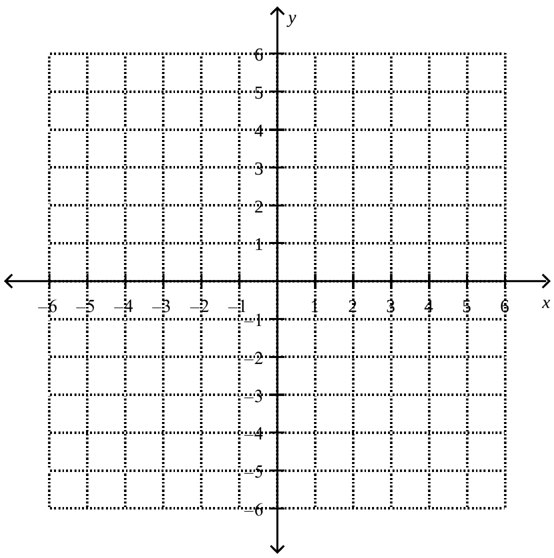


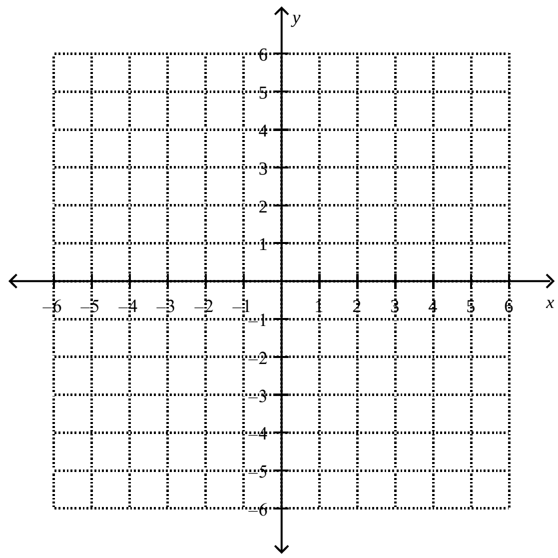


Solve the system graphically. Confirm the solution algebraically.

Ex. 4) $\begin{cases} x - y = 6 \\ y = -2x \end{cases}$

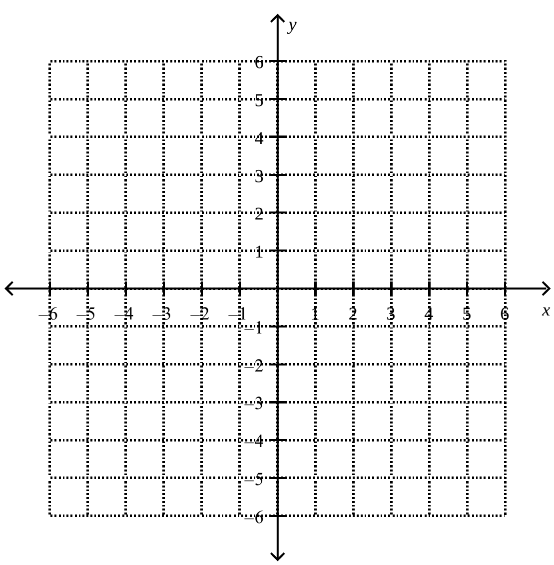
Try-It) $\begin{cases} 2x - y = 1 \\ 3x + y = -6 \end{cases}$

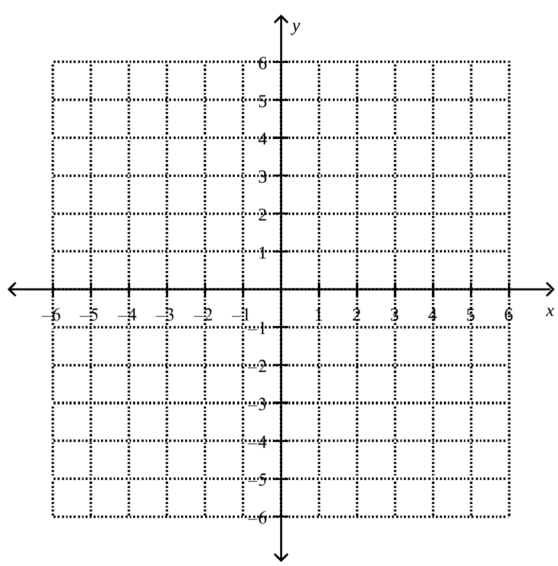




Try-It) $\begin{cases} 2x - y = 5 \\ x - y = 1 \end{cases}$

Try-It) $\begin{cases} -2x + y = -5 \\ y = 2 - \dfrac{1}{3}x \end{cases}$

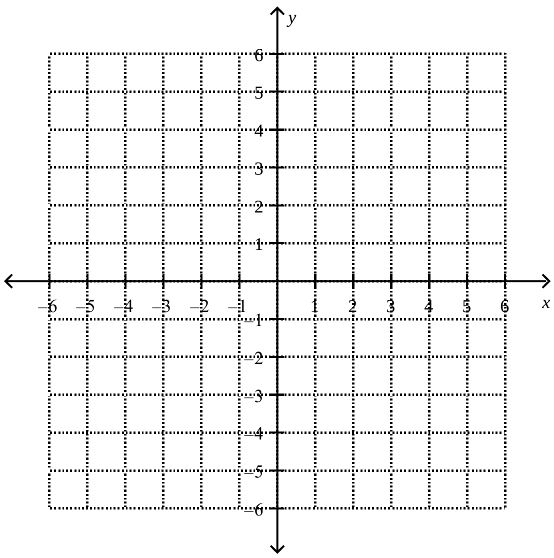


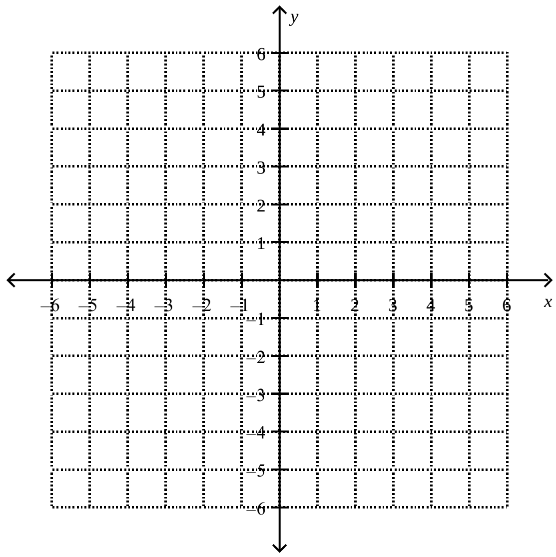


Solve the system graphically. Confirm the solution algebraically.

Ex. 2) $\begin{cases} x = 2 \\ y = -6 \end{cases}$

Try-It) $\begin{cases} y = 3 \\ x = -4 \end{cases}$





Solve the system by graphing in your calculator

1. y – 3x = 7 y + 2x = 2

2. 3x – y = 9 x + 2y = 10

3. 4x – 3y = -4 -3x + 5y = -8

Sometimes, problems involve two linear equations that have to be solved simultaneously. The task is to find one pair (x, y) of values that satisfies both linear equations.
Students in the Hamilton High School science club faced this kind of problem when they tried to raise $240 to buy a special eyepiece for the high-powered telescope at their school. The school PTA offered to pay club members for an after-school work project that would clean up a nearby park and recreation center building.
Because the outdoor work was harder and dirtier, the deal with the PTA would pay $16 for each outdoor worker and $10 for each indoor worker. The club had 18 members eager to work on the project. But, most members would prefer the easier indoor work.

$16x + 10y = 240$ and $x + y = 18$

a What do the variables x and y represent in these equations?

b What problem condition is represented by each equation?

c What are some combinations of numbers of outdoor and indoor workers that will allow the club to earn just enough money to buy the telescope eyepiece? Will any of those combinations also put each willing club member to work?

d What different strategies could you use to find a pair of values for x and y that satisfy both linear equations simultaneously?

Work on the problems of this lesson will develop your skill in writing, interpreting, and solving systems of linear equations.

Investigation 1 Solving with graphs and substitution

There are several different methods for solving systems of linear equations. As you work on the problems of this investigation, look for answers to this question:

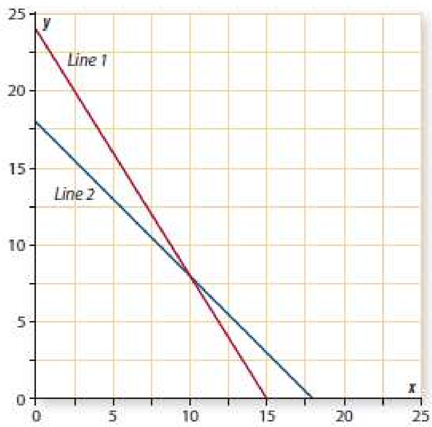
How can graphs and algebraic substitution be used to solve systems of linear equations?

As you discussed in the Think About This Situation, a system of linear equations expressing the conditions in the science club's situation is:

$16x + 10y = 240$ and $x + y = 18$

The first equation shows that the amount of money they can earn is a linear function of the variables x and y, where x and y represent the number of outdoor and indoor workers, respectively. The second equation shows that the number of club members who will work is also a linear function of those variables.

The diagram below shows graphs (in the first quadrant) of solutions to the equations $16x + 10y = 240$ and $x + y = 18$.



a. Match the graphs to the linear equations they represent. Explain how you know that your answers are correct.

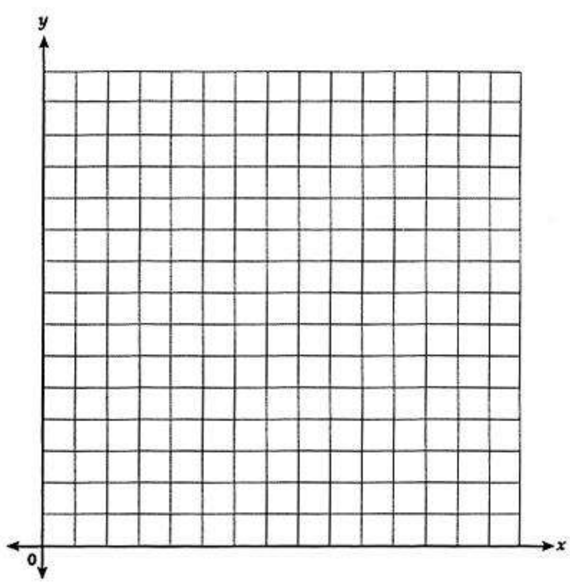
b. Use the graphs to estimate a solution (x, y) for the system of equations—values for x and y that satisfy both equations. what the solution tells about the science club's fund-raising situation.

c. Since graphs give only estimates for solutions of equations, it is important to check the estimates. Show how your graph-based estimate can be checked to see if it is an exact solution to the system.

2. When the date for the work project was set, it turned out that only 13 science club members could participate. The club president talked again with the PTA president and got a new pay deal—$20 per outdoor worker and $15 per indoor worker.

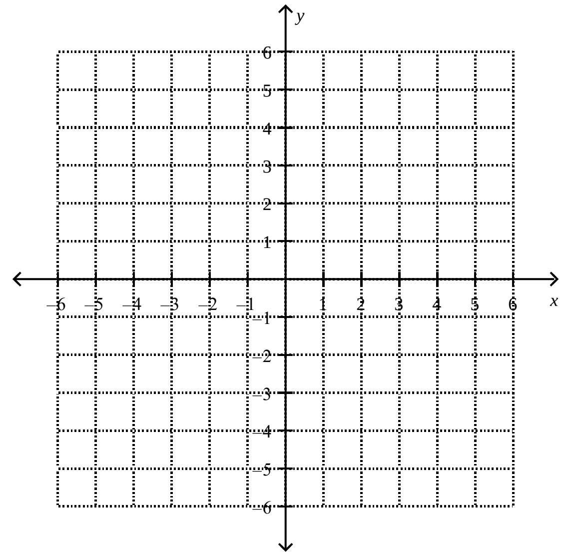
a. Write a system of linear equations in which one equation expresses the new conditions about payment and the other shows the new number of workers.

b. Estimate the solution for this system of equations by using graphs of the two equations. Then check your estimate.



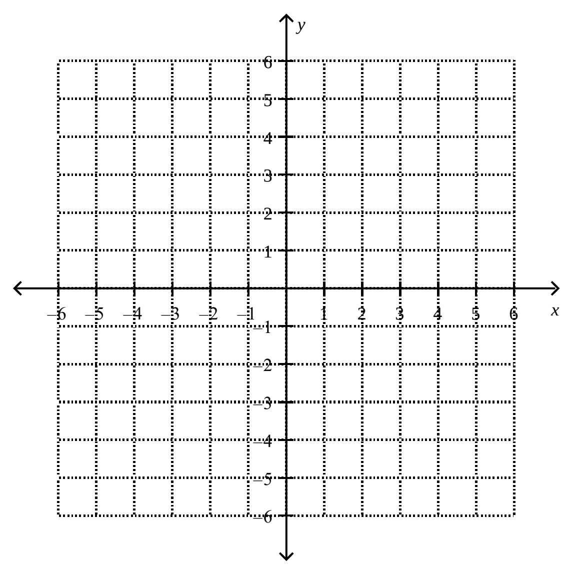
Systems with No solutions

1.): $\begin{cases} y = 3x + 2 \\ y = 3x - 2 \end{cases}$



Systems with Infinitely Many solutions

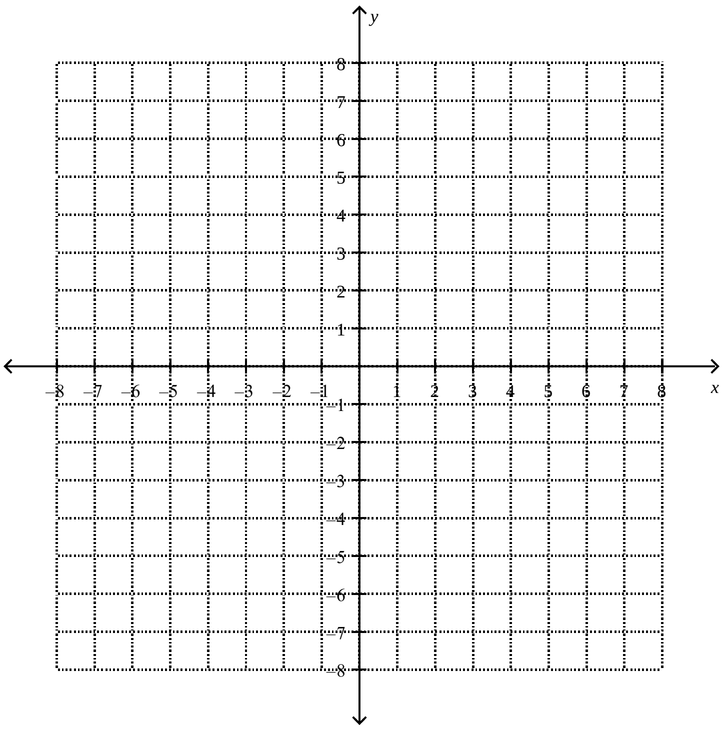
2.) $\begin{cases} y = -\dfrac{3}{4}x + 3 \\ y = -\dfrac{3}{4}x + 3 \end{cases}$



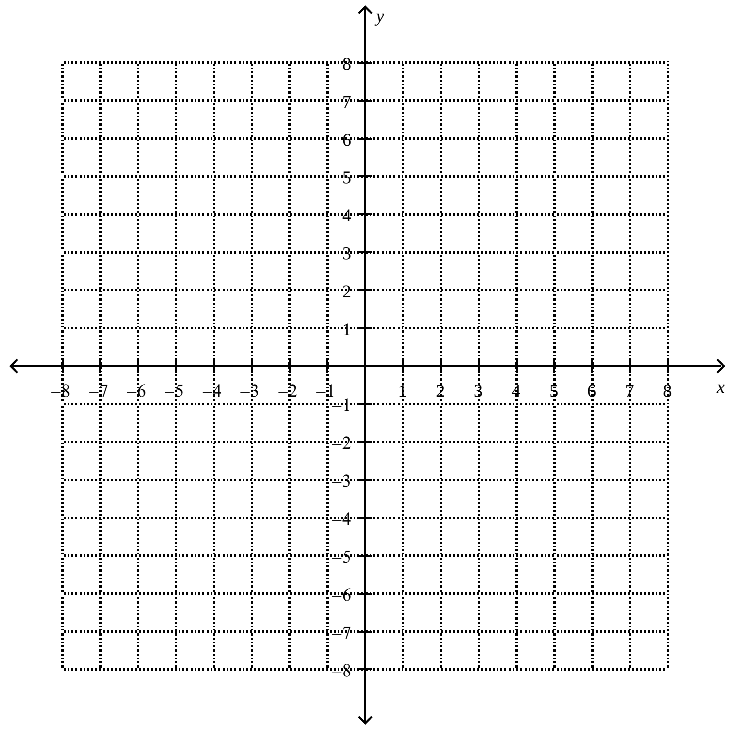
Main Ideas	Details
	Art fundraiser • The Kesling Middle School booster club is planning a community event to raise money for the school's art department. • Based on previous fund-raising events, they estimate that the event will be a sellout-filling all 400 seats. Plans are to charge adults \$10 and children \$5.The club wants to earn \$3000. a. Write an equation that expresses the relationship among adult attendance, and the goal for income from admission charges. b. Explain what the variables represent c. Write an equation that expresses the relationship among number of adults, number of children, and total attendance. d. Explain what the variables mean. e. Solve the system of linear equations using the graphing method and your calculator.

Main Ideas	Details
	Fitness Competition • Carly is training for an upcoming fitness competition and is trying to find a breakfast combination that meets her nutritional requirements of **1500 calories** and **50 grams of protein.** One serving of her cereal of choice has **250 calories and 5 grams of protein**. Her favorite brand of peanut butter contains **250 calories and 10 grams** of protein per serving. • Write a system of equations to find the number of servings for each type of food that would meet both of her nutrition goals. Use your calculator to complete this task. Airplane Tickets • Laura and Andy are trying to earn money to buy airplane tickets to visit their favorite aunt, Annie. Laura's ticket is going to cost her **$280 to visit** their favorite aunt, Annie. Andy's ticket is going to cost him **$230 money**, they have both decided to mow lawns and babysit. Laura charges **$7 per hour** for babysitting while Andy charges **$5 per hour.** To mow a lawn, Laura charges **$14 per lawn** while Andy charges **$16 per lawn**. • Write a system of equations to find the number of hours each needs to babysit and to find how many lawns they each need to mow. Use your calculator to complete this task.

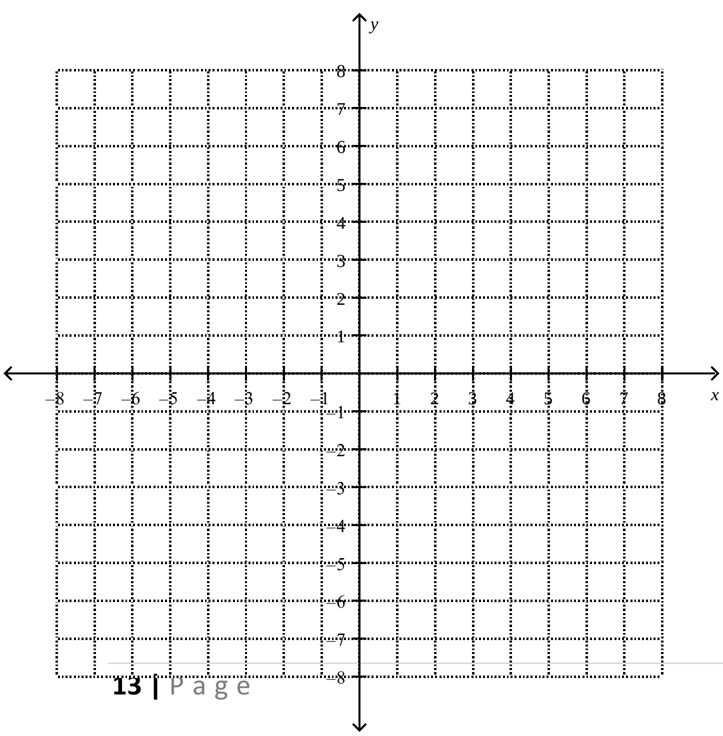
1. Graph $\begin{matrix} y \ge 2 \\ x < -3 \end{matrix}$.



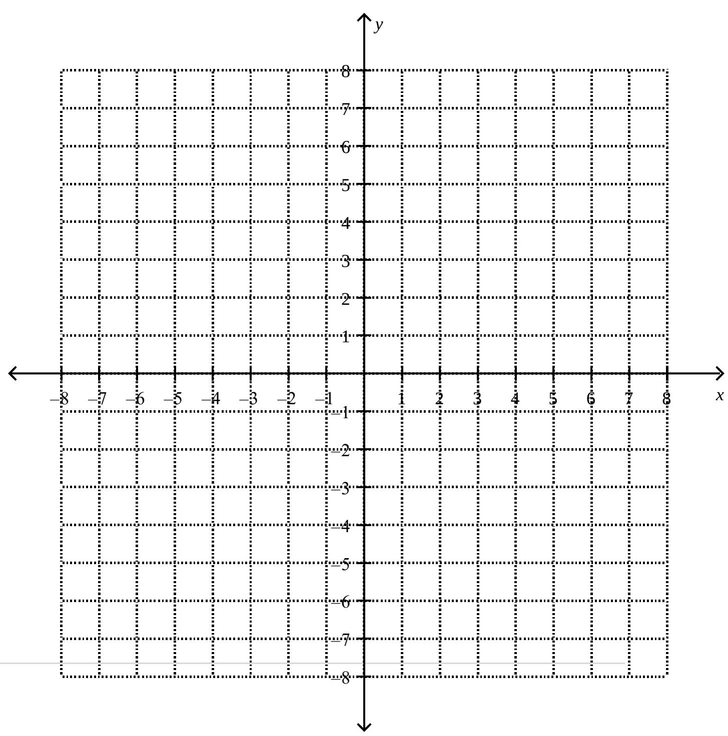
#2. Graph $\begin{matrix} y < 2x + 1 \\ y \ge \frac{1}{2}x \end{matrix}$.



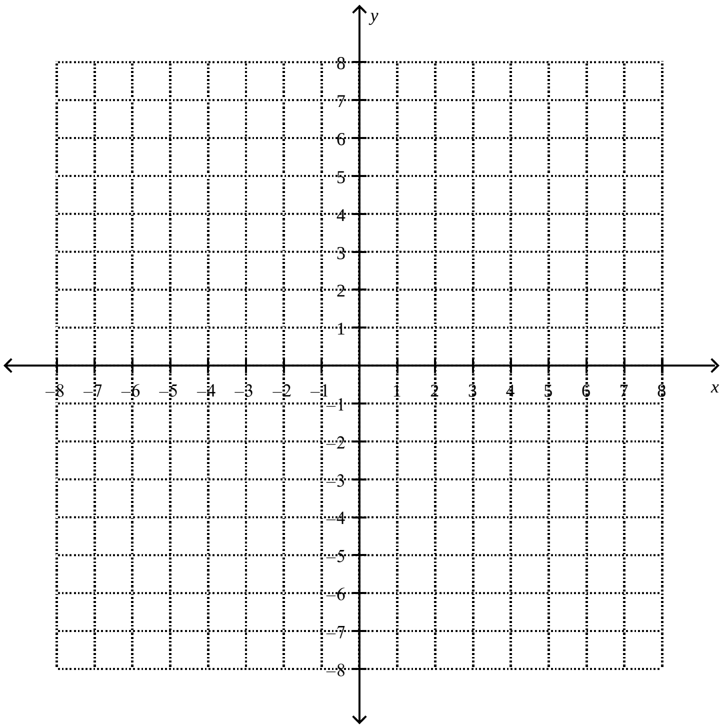
#3. Graph $\begin{matrix} x + y \ge 4 \\ -3x + y < 1 \end{matrix}$.



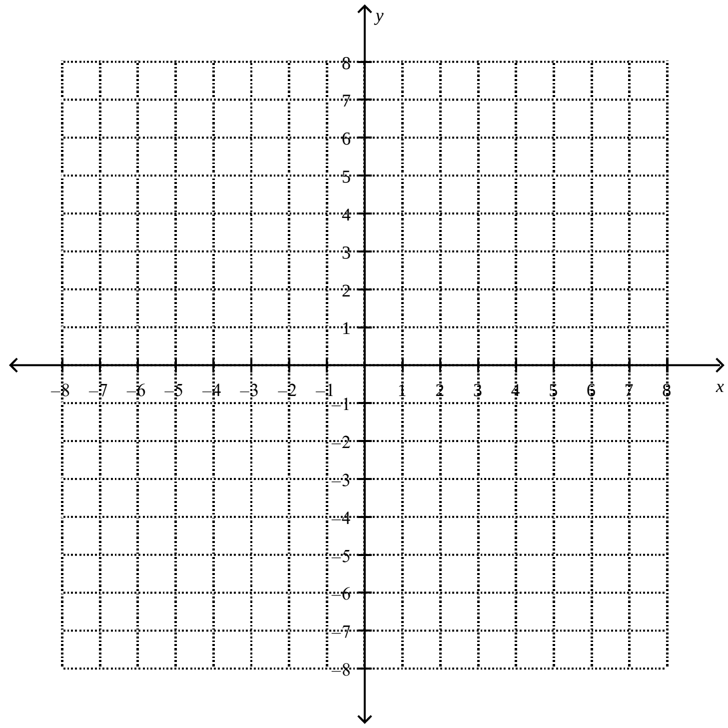
#4. Graph $\begin{matrix} 2x + 3y < 4 \\ 2x + 3y > -9 \end{matrix}$.



#5. Graph $\begin{array}{l} 3x-4y>2 \\ 3x-y\geq 2 \end{array}$



#6. Graph $\begin{array}{l} x\geq 0 \\ y\leq 0 \\ y>x-2 \end{array}$



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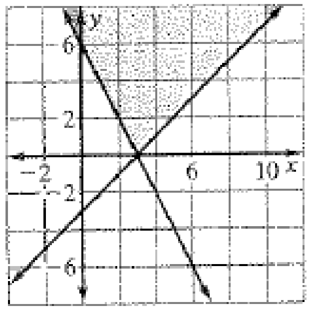
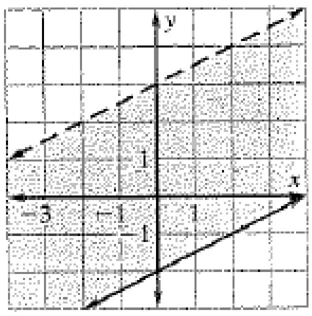
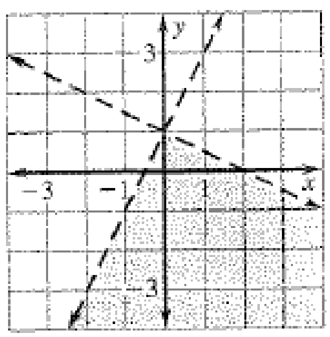
<tr><th>Main Ideas</th><th>Details</th></tr>
<tr><td>Write a system of Linear Inequalities that describes the graph</td><td>







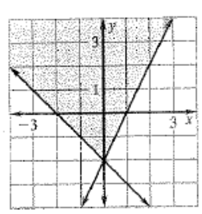
Match the system of linear inequalities with its graph.

A. $x + y \le 4$
$x + y \ge -2$

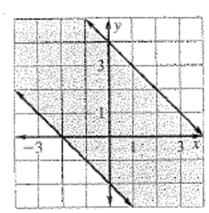
B. $x + 2y \le 4$
$-2x + y \ge -2$

C. $x + y \ge -2$
$-2x + y \ge -2$

1.



2.



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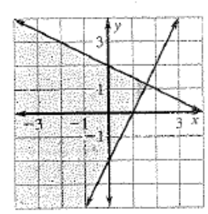

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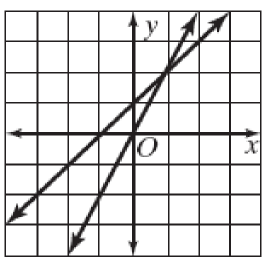
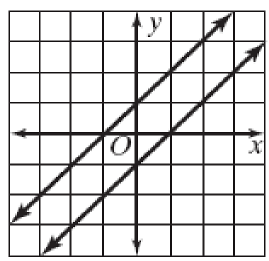
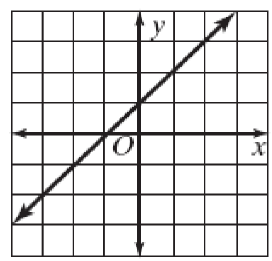
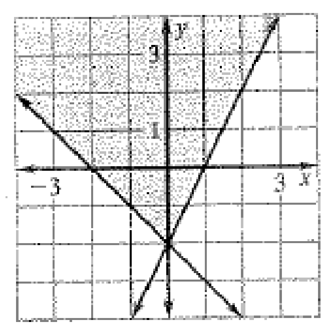
Systems of Linear Equations and Inequalities: Algebraically Substitution and Elimination





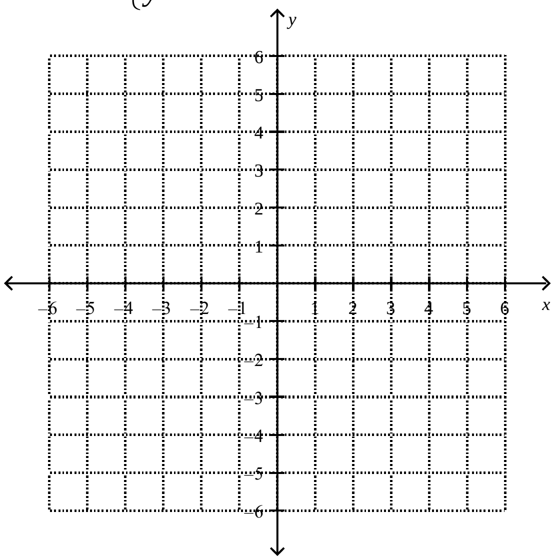




Solving Systems Algebraically – set them equal & substitution

Graph the following system of equations, find the solution.

1. $\begin{cases} y = 2x + 6 \\ y = x + 3 \end{cases}$



1. $\begin{cases} y = 2x + 6 \\ y = x + 3 \end{cases}$

Try It! – Solve Algebraically

a. $\begin{cases} y = 3x - 30 \\ y = -x + 14 \end{cases}$

b. $\begin{cases} x = -4y + 1 \\ x = y - 4 \end{cases}$

Main Ideas	Details
	1. $\begin{cases} y = 22x + 4 \\ y = 14x + 36 \end{cases}$ **2.** $\begin{cases} y = -x + 16 \\ y = -7x - 8 \end{cases}$

Main Ideas	Details
	Trey's online music club charges a monthly rate of \$20 plus \$0.80 per song download. Deb's online music club charges a monthly rate of \$21 plus \$0.60 per song download. For what number of songs will the monthly charge be the same for both clubs? How much will it cost? One car model costs \$12,000 and costs an average of \$0.10 per mile to maintain. Another car model costs \$14,000 and costs an average of \$0.08 per mile to maintain. If one of each model is driven the same number of miles, after how many miles would the total cost be the same?

Substitution Method	Details
	1. $y = 5x$ and $6x - 2y = -4$ **2.** $\begin{cases} y = x - 2 \\ 2x + 2y = 4 \end{cases}$

	3. $\begin{cases} x = -4y - 4 \\ 3x + 5y = 2 \end{cases}$ 4. 4x – y = 5 and x = 8 – 2y

	a. $5x - y = -15$ and $x + y = -3$ b. $-7x + y = 32$ and $2x + 3y = 27$

	c. $2x + y = 5$ and $4x - 3y = -10$ d. $4x + 2y = 7$ and $x – 5y = 10$

A system of linear equations expressing the conditions in the science club's situation is:

$16x + 10y = 240$ and $x + y = 18$

The first equation shows that the amount of money they can earn is a linear function of the variables x and y, where x and y represent the number of outdoor and indoor workers, respectively. The second equation shows that the number of club members who will work is also a linear function of those variables.

a. Use the substitution method to find the solution (x, y) for the system of equations—values for x and y that satisfy both equations. What the solution tells about the science club's fund-raising situation.

2. When the date for the work project was set, it turned out that only 13 science club members could participate. The club president talked again with the PTA president and got a new pay deal—$20 per outdoor worker and $15 per indoor worker.

a. Write a system of linear equations in which one equation expresses the new conditions about payment and the other shows the new number of workers.

b. Use the substitution method to find the solution (x, y) for the system of equations—values for x and y that satisfy both equations. What the solution tells about the science club's fund-raising situation.

Special Solutions Substitution Method	Details
	1. $\begin{cases} y = 2x + 3 \\ y = 2x + 2 \end{cases}$ **2.** $\begin{cases} y = 4x - 3 \\ y = 4x - 3 \end{cases}$

	3. $\begin{cases} y = x - 2 \\ 2x + 2y = 4 \end{cases}$ **4.** $\begin{cases} y = -3x + 4 \\ 6x + 2y = 7 \end{cases}$ **5.** $\begin{cases} y = 3x - 6 \\ -3x + y = -6 \end{cases}$

Main Ideas	Details
	Solve each of the following systems using the substitution method.(Toolkit) a. $x - y = 4$ $\quad$ $2x - 2y = 8$ b. $3x - 6y = -46.5$ $\quad$ $-x + 2y = 15.5$ c. $x - 2y = 0$ $\quad$ $3x - 5y = 2.5$

Main Ideas	Details
	Art fundraiser • The Kesling Middle School booster club is planning a community event to raise money for the school's art department. • Based on previous fund-raising events, they estimate that the event will be a sellout-filling all 400 seats. Plans are to charge adults $10 and children $5.The club wants to earn $3000. Write a system of linear equations and solve using the substitution method

Solving by Elimination/Addition Method
Examples:

1. $\begin{cases} x+y=3 \\ x-y=-9 \end{cases}$

2. $\begin{cases} 2x-4y=10 \\ -2x+6y=-4 \end{cases}$

Try It!

a. $\begin{cases} 2x+y=3 \\ -2x+y=1 \end{cases}$

b. $\begin{cases} x+y=30 \\ x-y=6 \end{cases}$

Examples:

3. $\begin{cases} 6x - 7y = -4 \\ -4x - 7y = 26 \end{cases}$

4. $\begin{cases} x + 3y = 9 \\ x - 2y = -6 \end{cases}$

Try It!

a. $\begin{cases} 5x + 7y = 77 \\ 5x + 3y = 53 \end{cases}$

b. $\begin{cases} 9x - 3y = 24 \\ 7x - 3y = 20 \end{cases}$

Now let's investigate some other systems that involve other uses of the elimination method.

5. $\begin{cases} 2x+5y=-1 \\ x+2y=0 \end{cases}$

6. $\begin{cases} 6x+3y=0 \\ -3x+3y=9 \end{cases}$

Try It!

a. $\begin{cases} 8x-9y=19 \\ 4x+y=-7 \end{cases}$

b. $\begin{cases} 4x-y=6 \\ 3x+2y=21 \end{cases}$

Examples:

1. $\begin{cases} 3x + 5y = 10 \\ 5x + 7y = 10 \end{cases}$

2. $\begin{cases} 15x + 3y = 9 \\ 10x + 7y = -4 \end{cases}$

Try It!

a. $\begin{cases} 2x - 3y = -11 \\ 3x + 2y = 29 \end{cases}$

b. $\begin{cases} 5x + 7y = -1 \\ 4x - 2y = 22 \end{cases}$

Main Ideas	Details

Solve the system using all three methods	Details
	a) $2x + y = -4$ $4x - 2y = 8$ b) $2x + y = -4$ $4x - 2y = 8$ c) $2x + y = -4$ $4x - 2y = 8$

A system of linear equations expressing the conditions in the science club's situation is:

$16x + 10y = 240$ and $x + y = 18$

The first equation shows that the amount of money they can earn is a linear function of the variables x and y, where x and y represent the number of outdoor and indoor workers, respectively. The second equation shows that the number of club members who will work is also a linear function of those variables.

a. Use the elimination method to find the solution (x, y) for the system of equations—values for x and y that satisfy both equations. What the solution tells about the science club's fund-raising situation.

2. When the date for the work project was set, it turned out that only 13 science club members could participate. The club president talked again with the PTA president and got a new pay deal—$20 per outdoor worker and $15 per indoor worker.

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	Fitness Competition • Carly is training for an upcoming fitness competition and is trying to find a breakfast combination that meets her nutritional requirements of **1500 calories** and **50 grams of protein.** One serving of her cereal of choice has **250 calories and 5 grams of protein**. Her favorite brand of peanut butter contains **250 calories and 10 grams** of protein per serving. • Write a system of equations to find the number of servings for each type of food that would meet both of her nutrition goals.

	Airplane Tickets • Laura and Andy are trying to earn money to buy airplane tickets to visit their favorite aunt, Annie. Laura's ticket is going to cost her **$280 to visit** their favorite aunt, Annie. Andy's ticket is going to cost him **$230 money**, they have both decided to mow lawns and babysit. Laura charges **$7 per hour** for babysitting while Andy charges **$5 per hour.** To mow a lawn, Laura charges **$14 per lawn** while Andy charges **$16 per lawn**. • Write a system of equations to find the number of hours each needs to babysit and to find how many lawns they each need to mow. Use your calculator to complete this task.

For some people, like athletes and astronauts selection of a good diet is a carefully planned scientific process. In the case of astronauts, proper nutrition is provided in limited forms. For example, drinks might come in disposable boxes and solid food in energy bars. Suppose that, in planning daily diets for a space shuttle team, nutritionists work toward these goals.

- Drinks each provide 30 grams of carbohydrate, energy bars each provide 40 grams of carbohydrate, and the optimal diet should contain 600 grams of carbohydrate per day.
- Drinks each provide 15 grams of protein, energy bars each provide 20 grams of protein, and the optimal diet should contain200 grams of protein.

The problem is to find a number of drinks and a number of energy bars that will provide just the right nutrition for each astronaut. If we use *x* to represent the number of drinks and *y* for the number of energy bars, the goals in diet planning can be expressed as a system of linear equations:

$30x + 40y = 600$ $\qquad$ $15x + 20y = 200$

Solve the system using the elimination method.

Suppose that the condition on protein in Problem 2 was revised to require 300 grams per day.

a. Write the new system of equations expressing the conditions relating number of drink boxes and number of food bars to the required grams of carbohydrate and protein in the diet.

b. Solve the system using the elimination method.

Main Ideas	Details
	1. $2y+3x=10$ $2x=5-3y$ 2. $\frac{1}{2}x+\frac{3}{4}y=9$ $-2x+y=-4$ 3. $1.8x+4y=-1$ $-2x-3.5y=3$ 4. $-\frac{1}{2}x+y=-6$ $x-\frac{2}{3}y=0$

Linear Programming

1. A company makes backpacks and briefcases. Daily output ***cannot exceed*** a total of 50 backpacks and briefcases. A ***maximum*** of 30 backpacks can be made in one day. The ***maximum*** daily output of briefcases is 20.

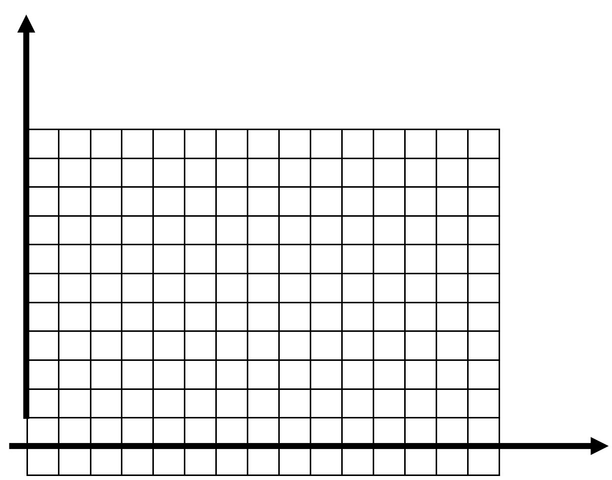
a) Define variables *x* and *y* for this problem.

Let *x* represent ________________________________
Let *y* represent ________________________________

b) State the constraints given in this problem. Write an inequality for each constraint.

c) Find the *x and y – intercepts* for the constraints above.

d) Draw a graph that shows the possible numbers of bags that can be made in 1 day.
Label the axis. Use a scale of* 5 *on both axes.



One possible solution is (,   )

Show that this works in all 3 inequalities

2. Alyssa plays soccer and baseball. She burns 600 calories/h playing soccer and 60 calories/h playing baseball. Each week she is willing to spend ***at most*** 30 h exercising and wishes to burn ***at least*** 5000 calories.

a) Define variables *x* and *y* for this problem.

Let *x* represent ______________________________

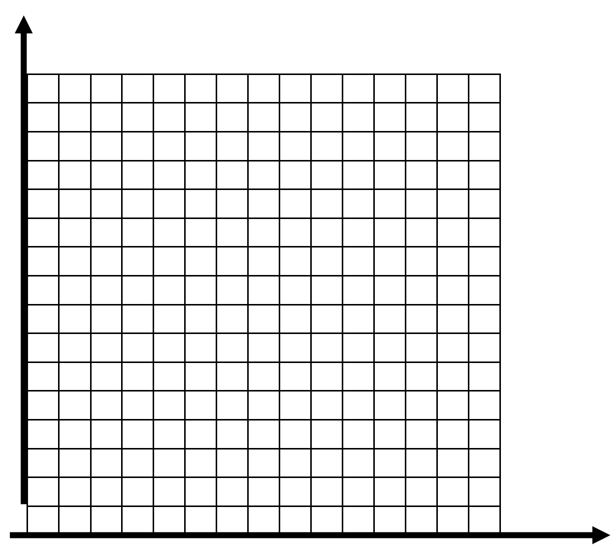
Let *y* represent ______________________________

b) Write a system of inequalities to represent the constraints in this problem.

c) Find the *x and y – intercepts* for the constraints above.

d) Draw a graph to show the time Alyssa could spend on each activity in one week.

***Label the axis. Use a scale of* 2 *on the x- axis and* 5** *on the y-axis*



One possible solution is (,   )

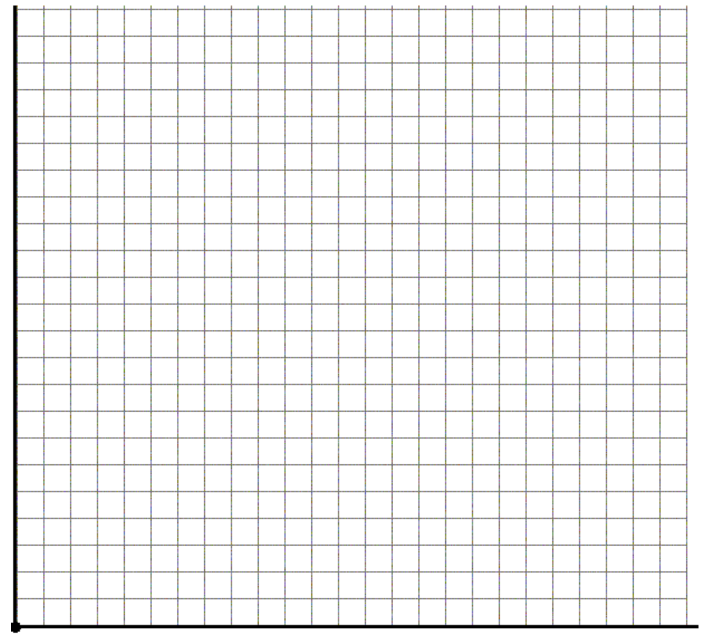
Show that this works in <u>both</u> inequalities

Main Ideas	Details

System of Inequalities – Walk through

1. You can work at most 30 hours next week. You need to earn at least $150 to cover you weekly expenses. Your dog- walking job pays $10 per hour and your job as a car wash attendant pays $5 per hour.

a) Define the variables.



_______________________________ = x

_______________________________ = y

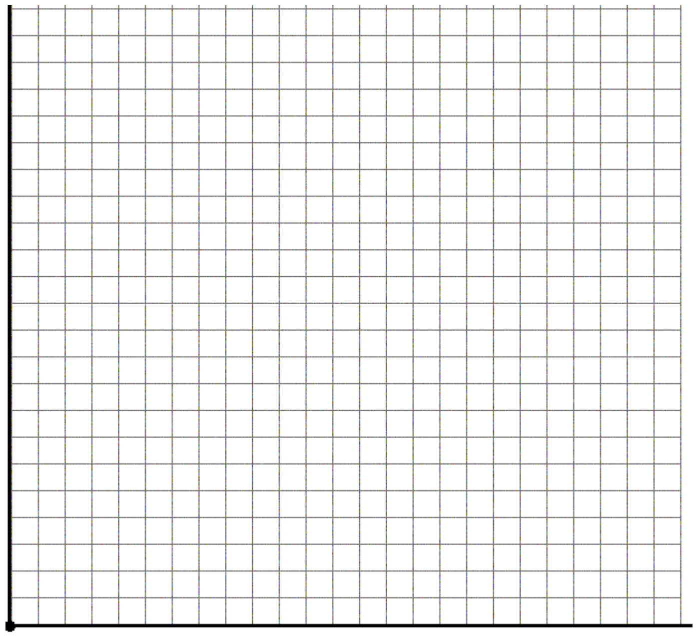
b) Write your constraints and solve as needed.

c) Graph your constraints. Identify your solution.

2. Marsha is buying plants and soil for her garden. The soil cost $5 per bag, and the plants cost $8 each. She wants to buy at least 8 plants and can spend no more than $150.

a) Define the variables.

________________________________ = x ________________________________ = y



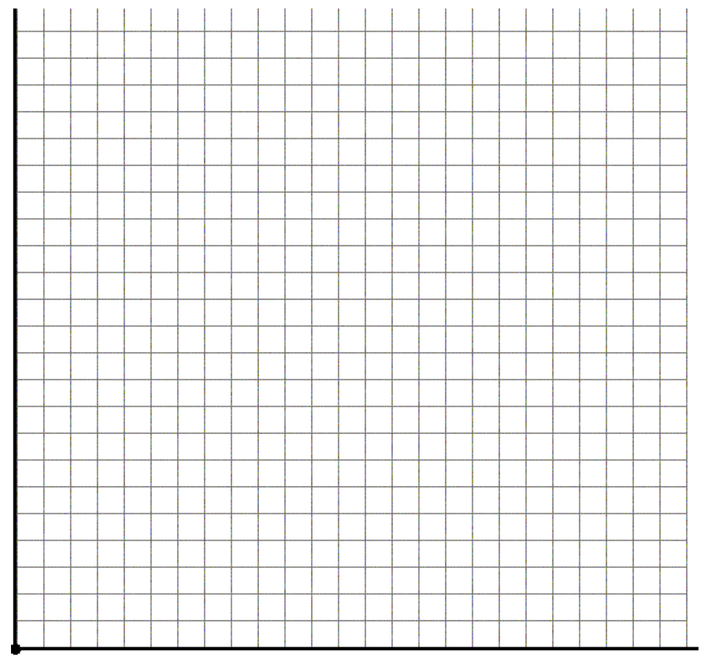
b) Write your constraints and solve as needed.

c) Graph your constraints. Identify your solution.

3. The area of a parking lot is 1000 square meters. A truck requires 10 square meters. A bus requires 25 square meters. The attendant can handle at most 50 vehicles.

b) Define the variables.

_______________________________ = x   _______________________________ = y

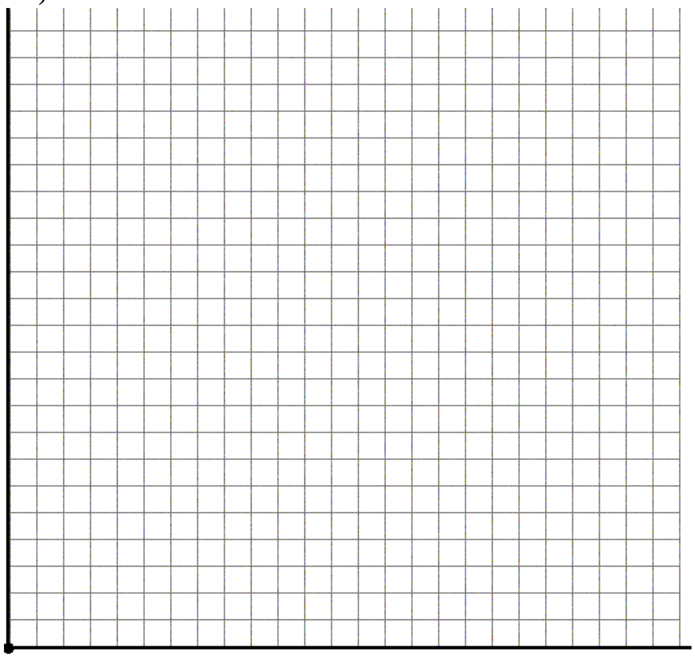


c) Write your constraints and solve as needed.

d) Graph your constraints. Identify your solution.

4. A theater wants to take in at least $1800 for a certain matinee. Children's tickets cost $6 each and adult tickets cost $9 each. The theater can seat up to 400 people.

a) Define the variables.



______________________________ = x

______________________________ = y

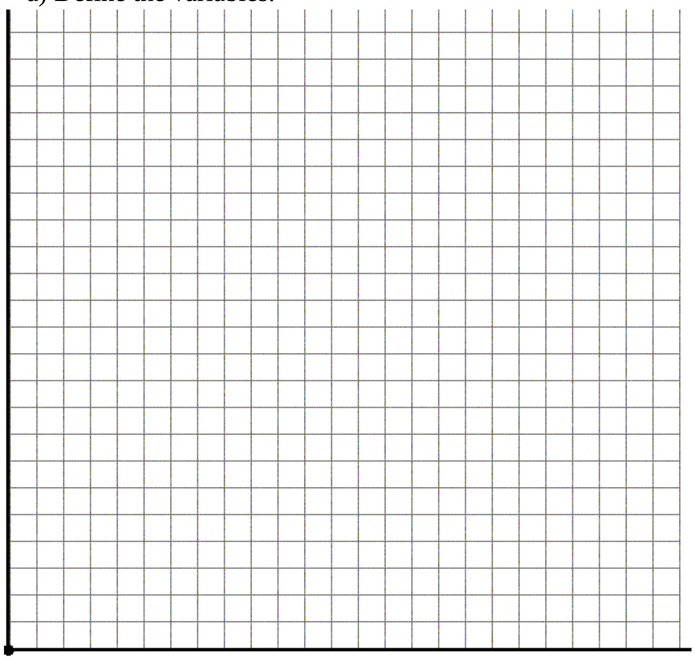
b) Write your constraints and solve as needed.

c) Graph your constraints. Identify your solution.

5. Oaken Treasures make two different kinds of chairs, rockers, and swivels. Work on machines A and B is required to make both kinds. Machine A can be run no more than 30 hours a day. Machine B is limited to 20 hours a day. The following chart shows the amount to time on each machine that is required to make one chair.

Chair	Operation A	Operation B
Rocker	1 h	2 h
Swivel	3h	2 h

a) Define the variables.



_______________________________ = x

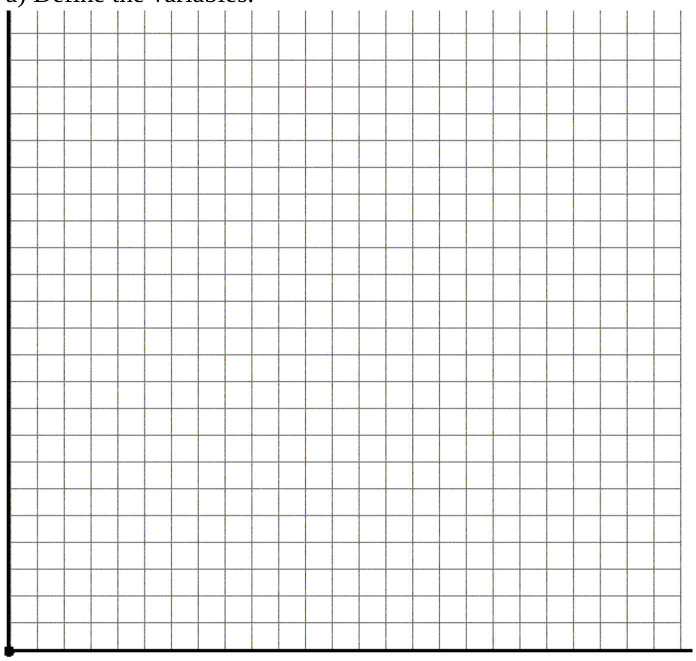
_______________________________ = y

b) Write your constraints and solve as needed.

c) Graph your constraints. Identify your solution.

6. A delivery service has a fleet of trucks. Each truck can accommodate a maximum weight of 4000 lb and 450 cubic ft of merchandise. A small refrigerator weights 20 lb and occupies 5 cubic ft of space. A 42-in television set weighs 40 lb and occupies 9 cubic ft of space.

a) Define the variables.



________________________________ = x

________________________________ = y

b) Write your constraints and solve as needed.

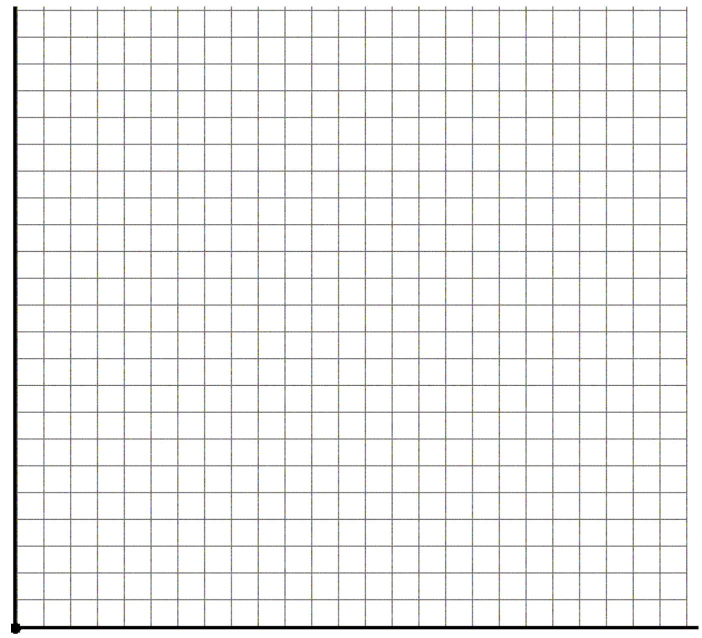
c) Graph your constraints. Identify your solution.

System of Inequalities – Word Problems

An office manager is purchasing file cabinets (in cubic feet). The office has 100 square feet of floor space for the cabinets and \$1000 in the budget to purchase them. Cabinet A requires 5 square feet of floor space, and costs \$100 dollars. Cabinet B requires 10 square feet of floor space, and costs \$150. Define the variables.

______________________________ = x

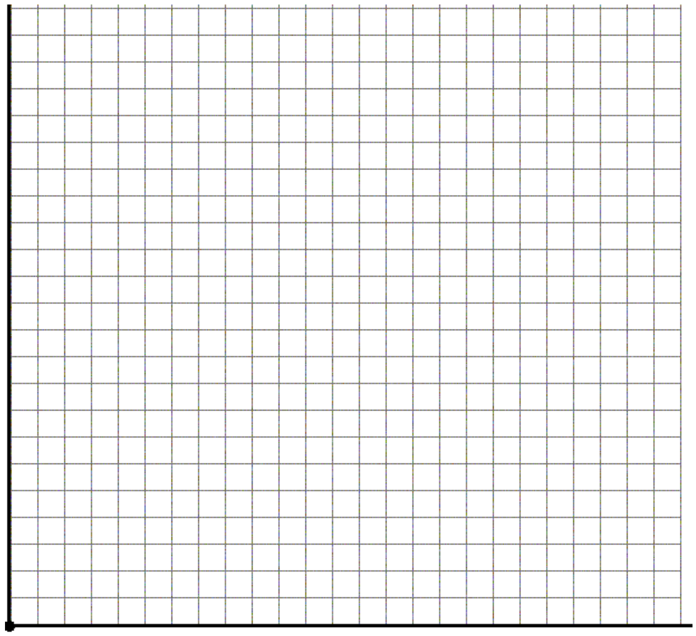
______________________________ = y



d) Write your constraints and solve as needed.

e) Graph your constraints. Identify your solution.

2. Superbats, Inc., manufactures two different quality wood baseball bats, the Wallbanger and the Dingbat. The Wallbanger takes 6 hours to trim and turn on a lathe and 3 hours to finish it. The Dingbat takes 8 hours to trim and turn on a lathe and 2 hours to finish. The total time per day available for trimming and lathing is 96 hours and for finishing is 60 hours.



Define the variables.

________________________________ = x

________________________________ = y

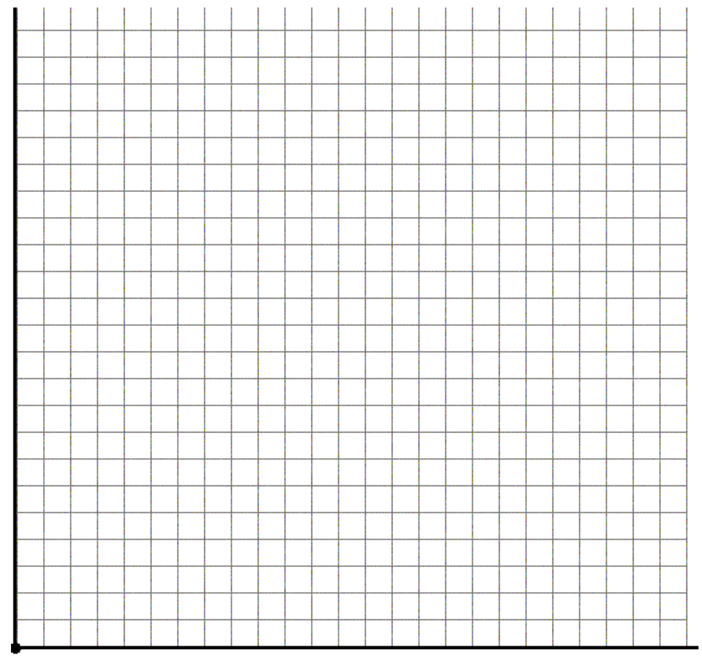
b) Write your constraints and solve as needed.

c) Graph your constraints. Identify your solution.

3. A ski company makes two types of skis and has a fabrication and a finishing department. A pair of downhill skis requires 8 hours to fabricate and 2 hour to finish. A pair of cross-country skis requires 6 hours to fabricate and 1 hour to finish. The fabricating department has 96 hours of labor available per day. The finishing department has 40 hours of labor available per day.

e) Define the variables.

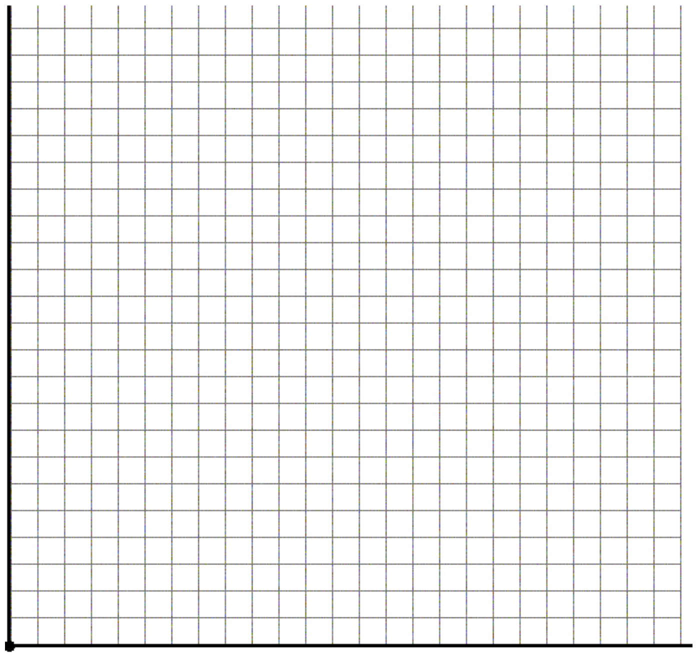
________________________________ = x   ________________________________ = y



f) Write your constraints and solve as needed.

g) Graph your constraints. Identify your solution.

4. Juan makes two types of wood clocks to sell at local stores. It takes him 4 hours to assemble a pine clock, which requires 2 oz of varnish. It takes 5 hours to assemble an oak clock, which takes 6 oz. of varnish. Juan has 24 oz. of varnish in stock, and can work 40 hours.



a) Define the variables.

_________________________________ = x

_________________________________ = y

b) Write your constraints and solve as needed.

b) Graph your constraints. Identify your solution.

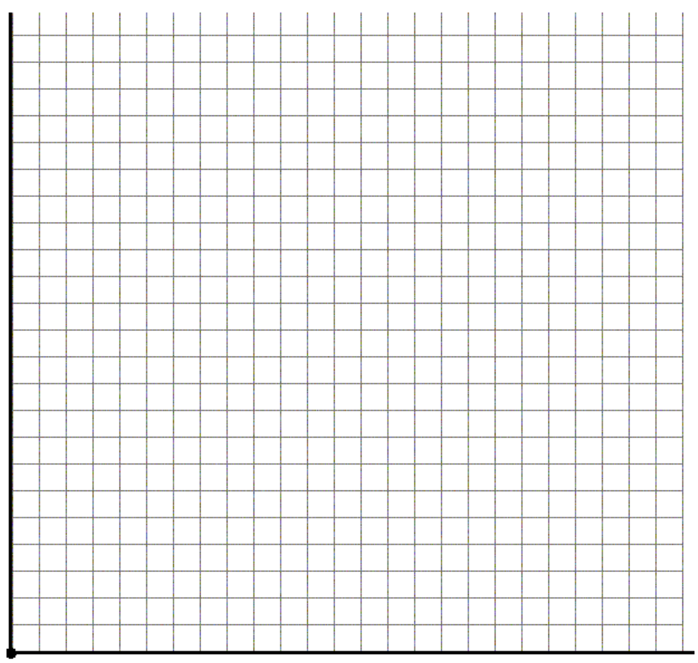
Main Ideas	Details
	Linear Programming with Optimization

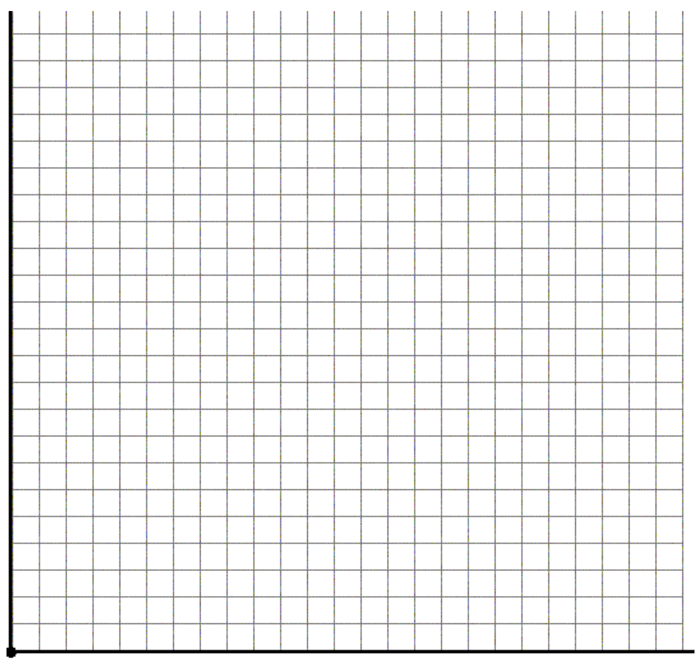
The area of a parking lot is 600 square meters. A car requires 6 square meters. A bus requires 30 square meters. The attendant can handle only 60 vehicles. If a car is charged $2.50 and a bus $7.50, how many of each should be accepted to maximize income?

Define the variables.

X = ___________________________ y = _________________________

Write your constraints and solve as needed.



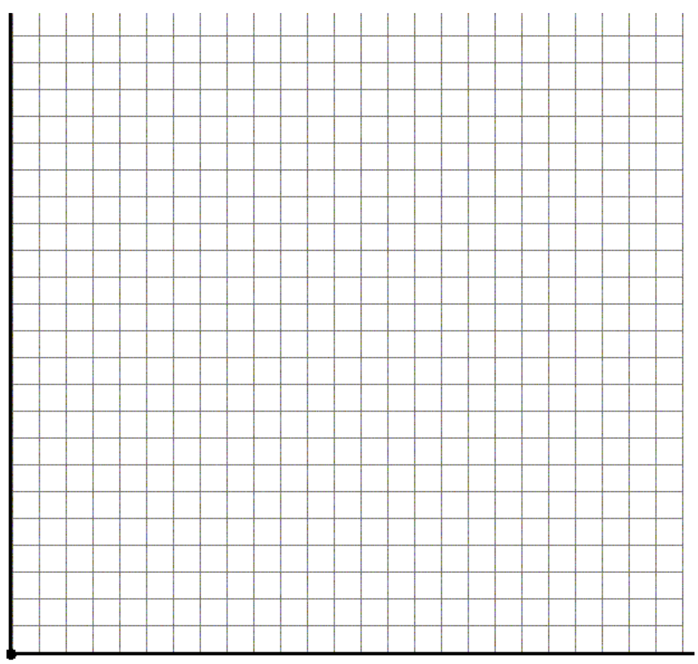
	The B&W Leather Company wants to add handmade belts and wallets to its product line. Each belt nets the company $18 in profit, and each wallet nets the company $12. Both belts and wallets require cutting and sewing. Belts require 2 hours of cutting and 6 hours of sewing time. Wallets require 3 hours of cutting time and 3 hours of sewing time. If the cutting machine is available 12 hours a week and sewing machine is available 18 hours per week, what ratio of belts and wallets will produce the most profit within the constraints? Define the variables. X = ____________________________ y = __________________________ Write your constraints and solve as needed. 

Toys-A-Go makes toys at Plant A and Plant B. Plant A needs to make a minimum of 1000 toy dump trucks and fire engines. Plant B needs to make a minimum of 800 toy dump trucks and fire engines. Plant A can make 10 toy dump trucks and 5 toy fire engines per hour. Plant B can produce 5 toy dump trucks and 15 toy fire engines per hour. It costs $30 per hour to produce toy dump trucks and $35 per hour to produce toy fire engines. How many hours should be spent on each toy in order to minimize cost?

Define the variables.

X = ___________________________ y = _________________________

Write your constraints and solve as needed.

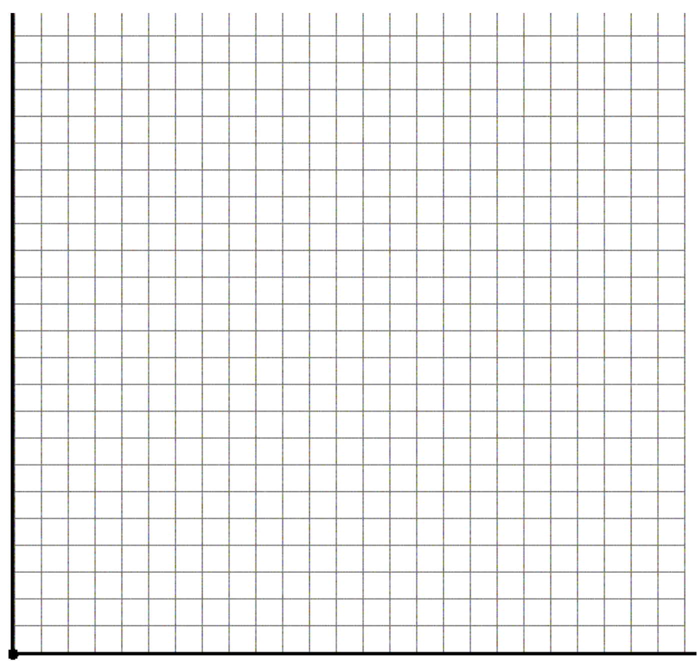


A diet is to include at least 140 milligrams of Vitamin A and at least 145 milligrams of Vitamin B. These requirements can be obtained from two types of food. Type X contains 10 milligrams of Vitamin A and 20 milligrams of Vitamin B per pound. If Type Y contains 30 milligrams of Vitamin A and 15 milligrams of Vitamin B per pound. If type X food costs $12 per pound and Type Y food costs $8 per pound, how many pounds of each type of food should be purchased to satisfy the requirements at the minimum cost?

Define the variables.

X = ___________________________ y = _________________________

Write your constraints and solve as needed.



The Cruiser Bicycle Company makes two styles of bicycles: The Traveler, which sells for $300 and the Tourister, which sells for $600. Each bicycle has the same frame and tires, but the assembly and painting time required for the Traveler is only 1 hour while it is 3 hours for the Tourister. There are 300 frames and 360 hours of labor available for production. How many bicycles of each model should be produced to maximize revenue?

Define the variables.

X = ___________________________ y = _________________________

Write your constraints and solve as needed.