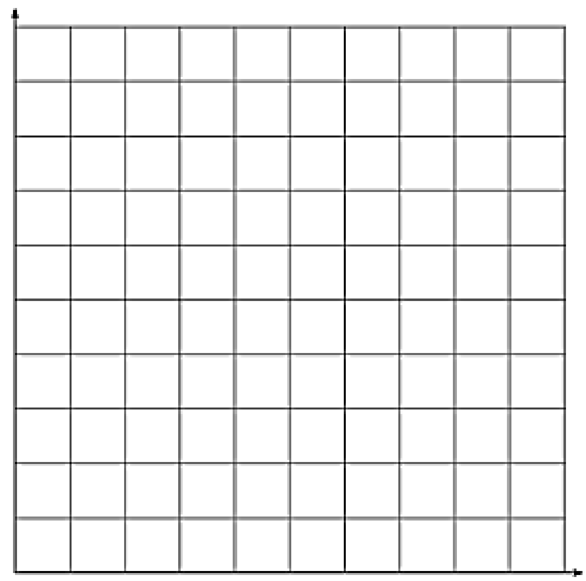
1.1A *Introduction to Linear Inequalities*

1) For Molly's reading assignment homework she receives 10 points for every nonfiction book she reads and 5 points for every fiction book she reads. Identify 5 combinations of nonfiction and fictions books that Molly can read to earn **<u>exactly</u>** 50 points.

# of nonfiction books	# of fiction books	Record your thinking of *how* you know this combination satisfies the conditional goal

a) Number and label the graph, then graph the points you have identified above along with **<u>all</u>** of the possible combinations of nonfiction and fiction books that she can read to get **<u>exactly</u>** 50 points. Is this a linear relationship? Explain why or why not.



b) Molly will earn a free homework pass for the next reading assignment if she earns **<u>more than</u>** 50 points. Identify 5 possible combinations of nonfiction and fiction books that would give her **<u>more than</u>** 50 points. On the coordinate grid, graph these 5 possible combinations along with all possible combinations that represent situations where she would earn more than 50 points.

# of nonfiction books	# of fiction books	Record your thinking of *how* you know this combination satisfies the conditional goal for part (b).

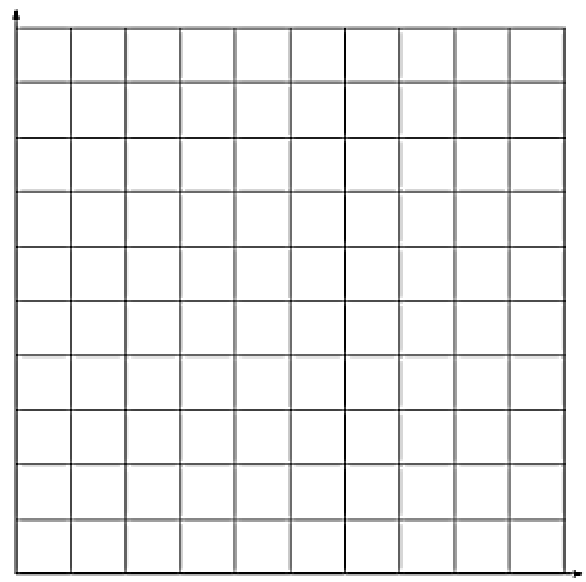
c) What differences are there between the graph of a linear equation (creating <u>exactly</u> 50 points) and the graph of a linear inequality (creating <u>more than</u> 50 points)?

1.1A *Introduction to Linear Inequalities*

2) Members of the Anoka High School Ski Club went on a ski-trip where members can rent skis for $16 per day and snowboards for $20 per day. The club only brought with $240 on the trip

a) Identify four possible combinations of ski rental and snowboard rental that would allow the Ski Club to spend **exactly** $240. Then graph them on the coordinate grid. (Remember to number and label your graph appropriately.)

# of ski rentals	# of snowboard rentals	Record your thinking of *how* you know this combination satisfies the conditional goal



b) **Identify** the *x*- and *y*-intercepts and **explain** the *meaning* of these two ordered pairs.

x-intercept _________ meaning: ____

y-intercept _________ meaning: ____

c) **Describe** what the graph would look like if you graphed **all** possible combinations of renting skis and snowboards that the club would be able to rent with the $240 they brought with.

1.1A *Introduction to Linear Inequalities*

#3 – 4: Determine whether each of the given points is a solution to the given linear inequality.

3) $-2x+y\geq 5$

a) (2, 9) **b)** (0, 2)

4) $3x-y<-4$

a) (–1, 1) **b)** (0, 5)

#5 – 9: Without graphing, determine if each point is in the shaded region for each inequality.

5) $\left(2,1\right)$ and $2x+y>5$

6) $\left(-1,3\right)$ and $2x-4y\leq -10$

7) $\left(-5,-1\right)$ and $y>-2x+8$

8) $\left(6,2\right)$ and $2x+3y\geq -2$

9) $\left(5,-6\right)$ and $2y<3x+3$

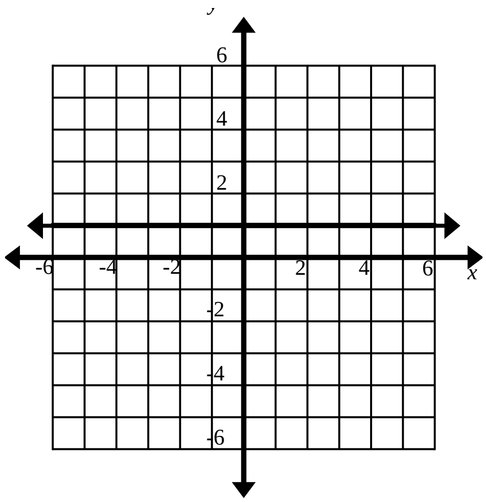
Section 1.1A

This page intentionally left blank

1.1B *Graphing Linear Inequalities*

#1 – 2: For each inequality and graph, complete the table of values for the boundary line then pick a point and use it to determine which half-plane should be shaded. Shade the correct half-plane.

1) $y \geq 1$



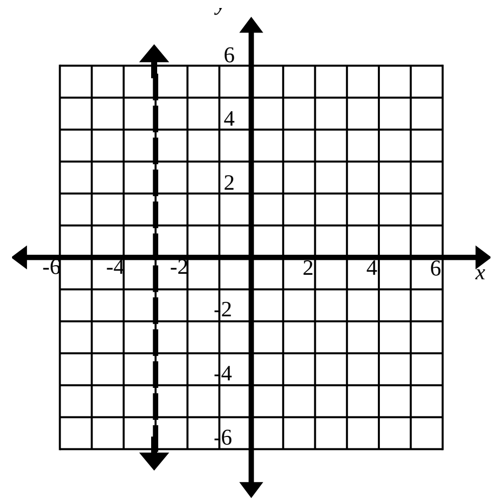
Points on the boundary line

x	*y*

2) $x < -3$

Points on the boundary line

x	*y*



#3 – 4: Determine whether each of the given points is a solution to the given linear inequality.

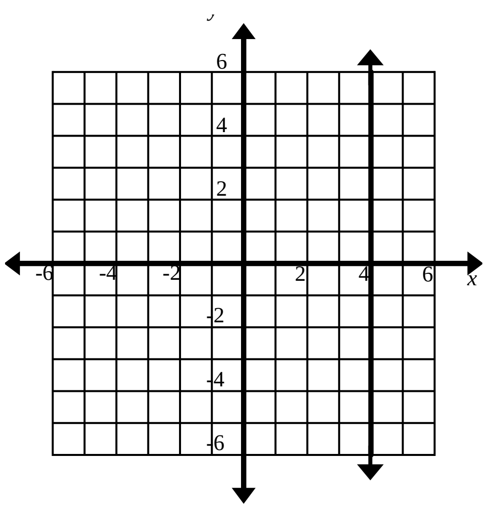
3) $y \geq 2x - 5$

a) (0, 0) **b)** (1, –3)

4) $y < -4x + 1$

a) (–2, 9) **b)** (3, 3)

5) Complete the table. Write the inequality for each of the following graphs:

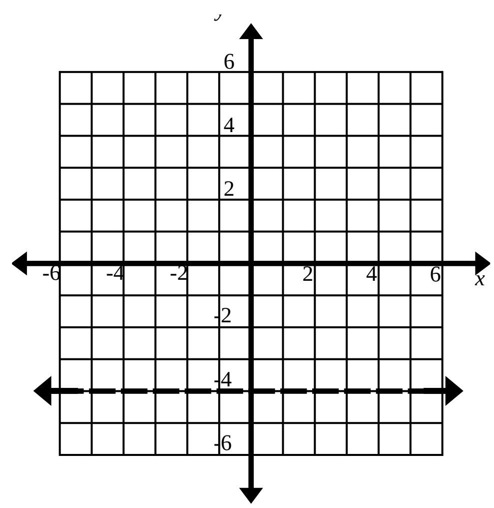


Points on the boundary line

x	*y*

Points on the boundary line

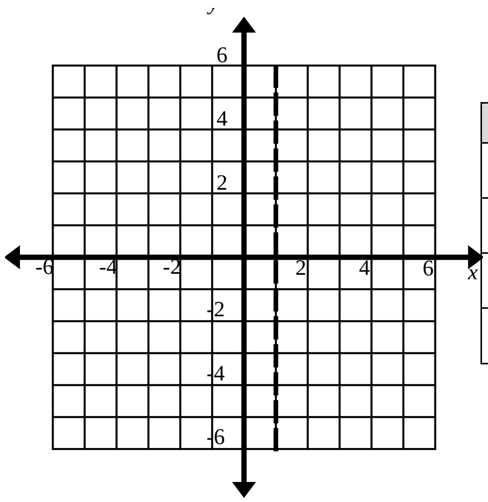
x	*y*



5a) ___________________ **5b)** ___________________

1.1B *Graphing Linear Inequalities*

6) Complete the table. Write the inequality for each of the following graphs:

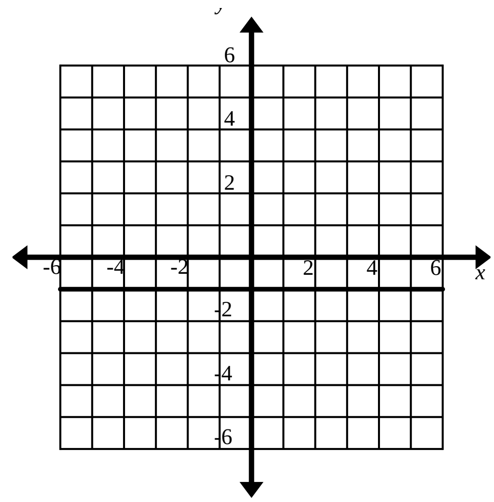


Points on the boundary line

x	*y*

Points on the boundary line

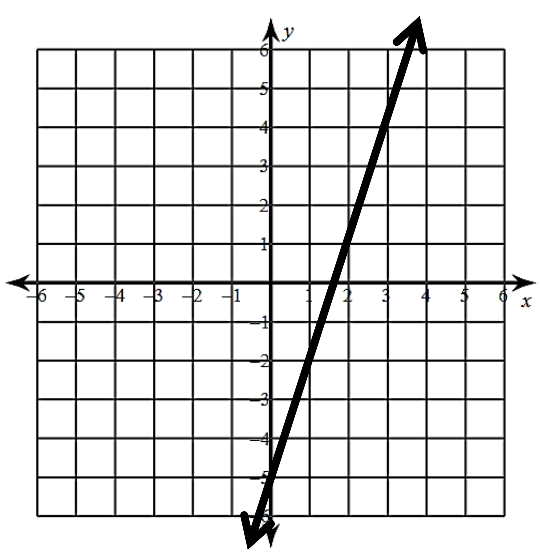
x	*y*

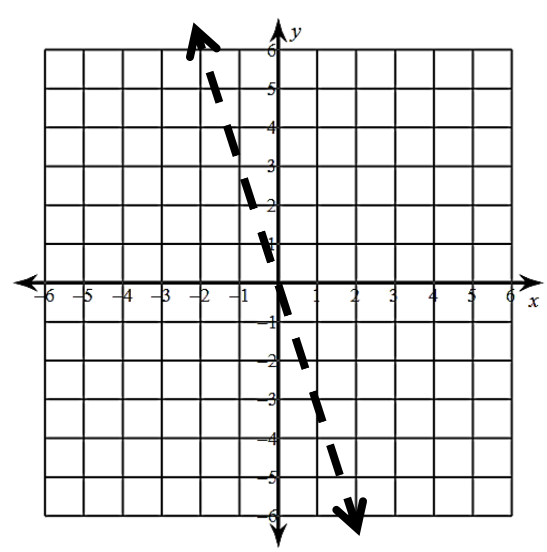


6a) ___________________ **6b)** ___________________

#7 – 10: For each inequality and graph, pick a point and use it to determine which half-plane should be shaded, and then shade the correct half-plane.

7) $y \geq 3x - 5$ **8)** $y < -3x$

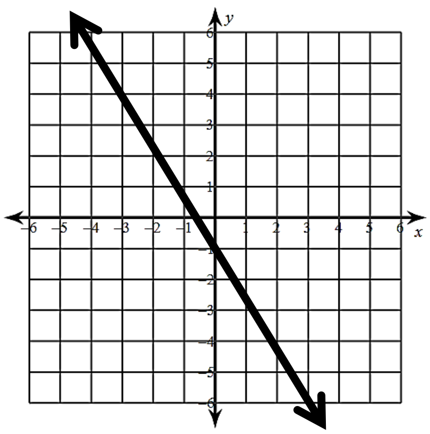




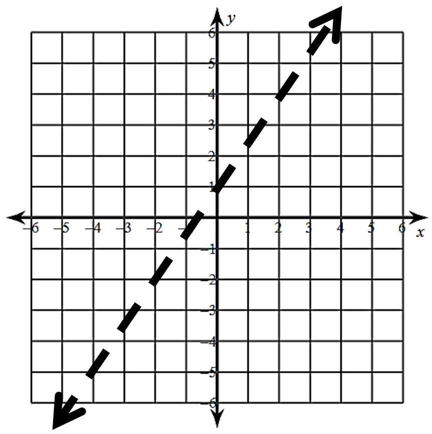
1.1B *Graphing Linear Inequalities*

#7 – 10 (continued): For each inequality and graph, pick a point and use it to determine which half-plane should be shaded, and then shade the correct half-plane.

9) $y \le -\frac{5}{3}x - 1$

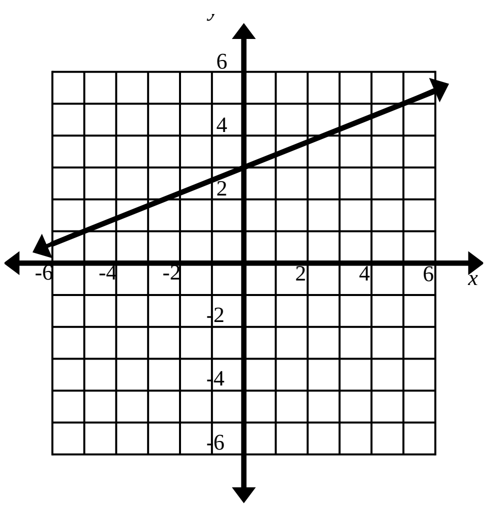


10) $2 < -3x + 2y$

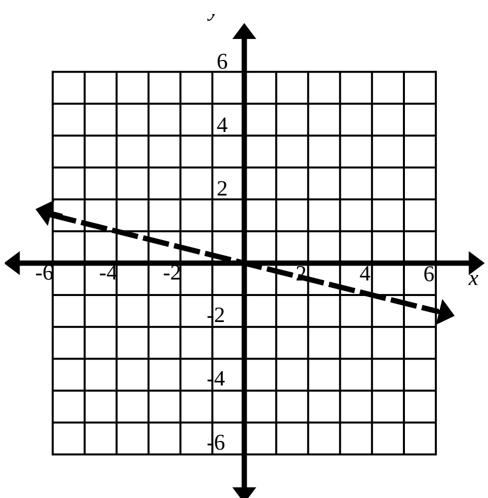


#11 – 12: Fill in the blank with the appropriate inequality sign.

11) $2x - 5y \,\square\, -15$



12) $y \,\square\, -\frac{1}{4}x$



Section 1.1B

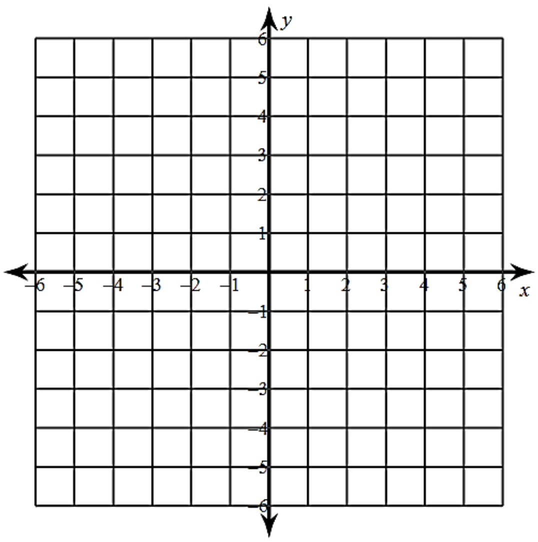
This page intentionally left blank

1.1C *Graphing Linear Inequalities in Standard Form and Slope-Intercept Form*

#1 – 4: Graph each inequality.

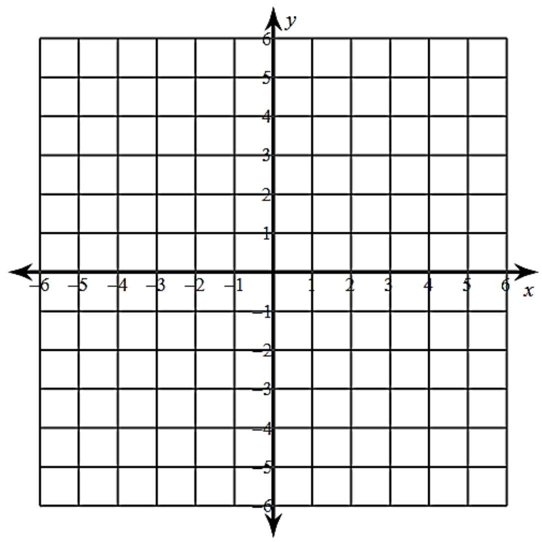
1) $y \geq 3x - 1$

x	0	
y		



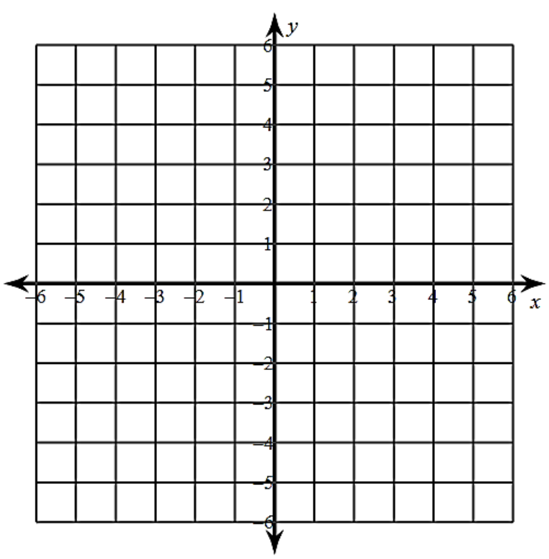
2) $y < -\frac{3}{4}x + 1$

x	0	4
y		



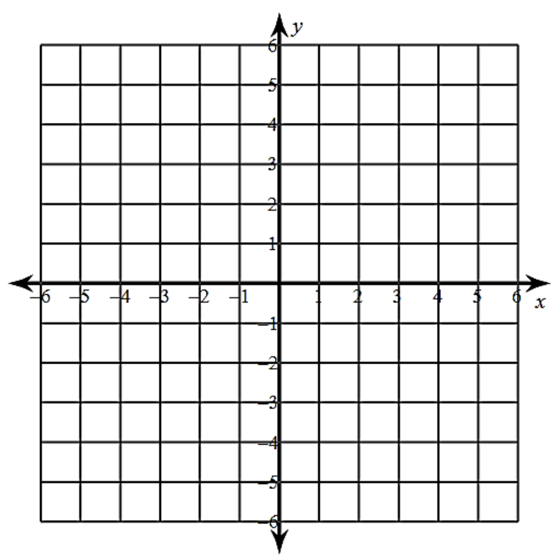
3) $y \leq \frac{5}{3}x + 4$

x	0	3
y		



4) $y \geq -2x$

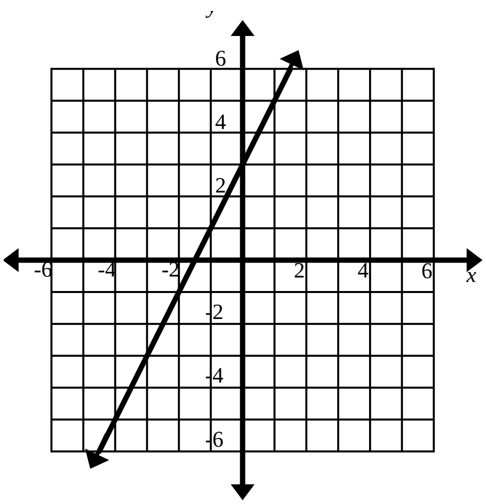
x		
y		



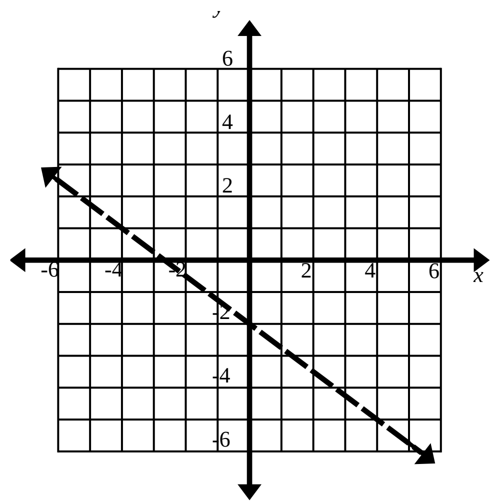
1.1C *Graphing Linear Inequalities in Standard Form and Slope-Intercept Form*

#5 – 8: For each inequality and graph, pick a point and use it to determine which half-plane should be shaded, and then shade the correct half-plane.

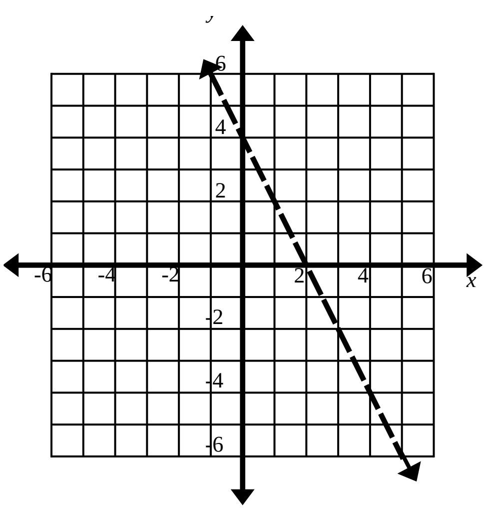
5) $y \;\square\; 2x+3$



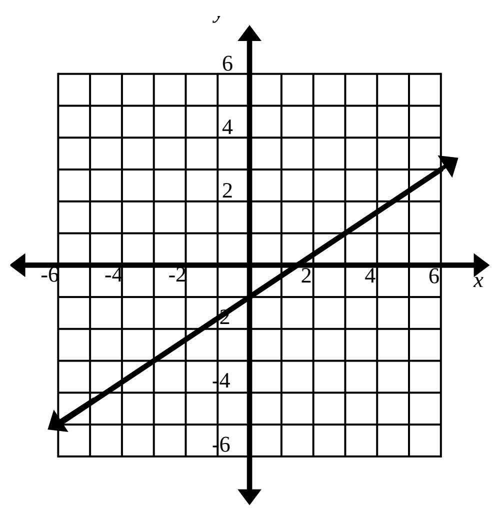
6) $-\frac{3}{4}x-2 \;\square\; y$



7) $-2x+4 \;\square\; y$



8) $y \;\square\; \frac{2}{3}x-1$

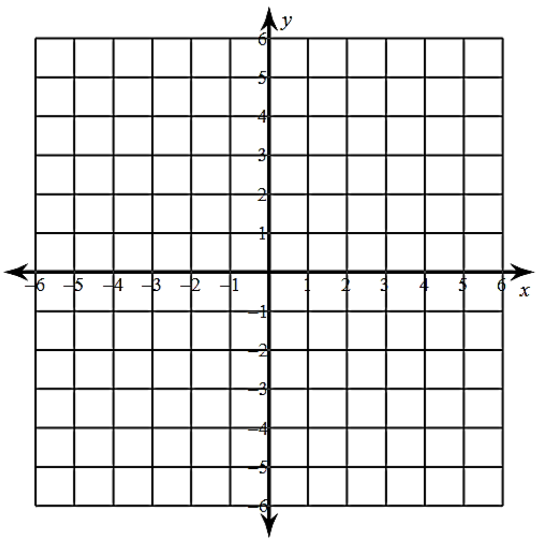


1.1C *Graphing Linear Inequalities in Standard Form and Slope-Intercept Form*

#9 – 12: Graph each inequality.

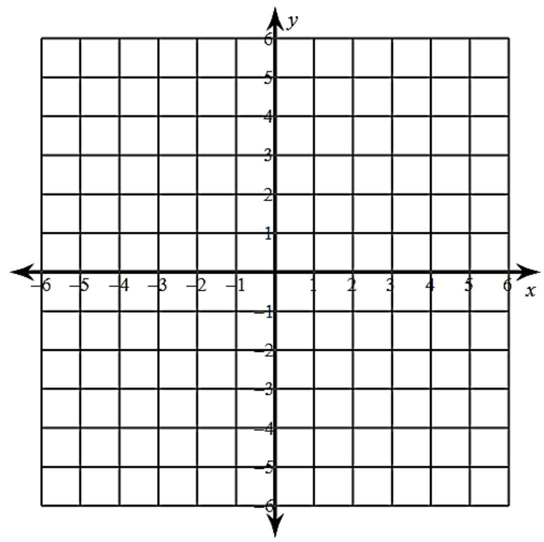
9) $2x + 3y \geq 12$

x	0	
y		



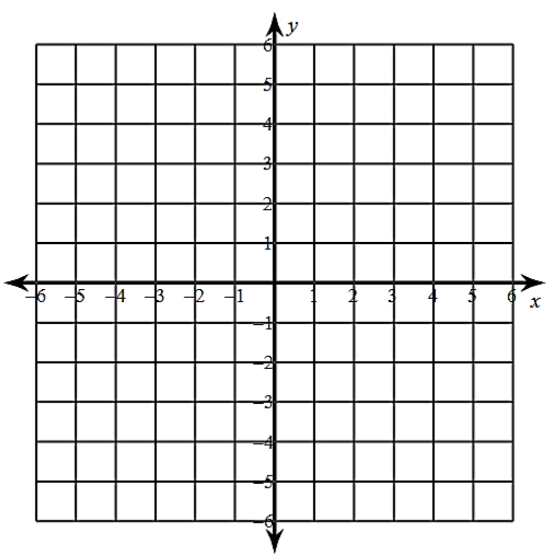
10) $5 < x + y$

x		
y	0	



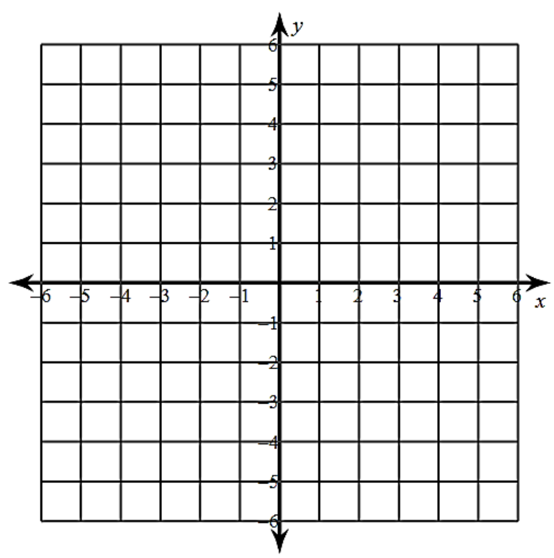
11) $x - 3y \geq 6$

x		
y		



12) $x - y \leq 0$

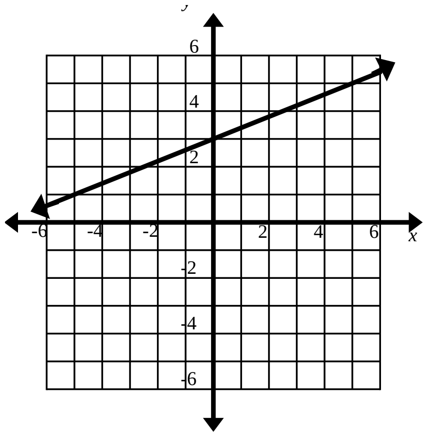
x		
y		



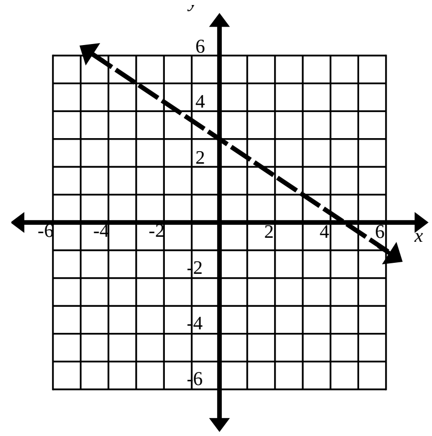
1.1C *Graphing Linear Inequalities in Standard Form and Slope-Intercept Form*

#13 – 16: For each inequality and graph, pick a point and use it to determine which half-plane should be shaded, and then shade the correct half-plane.

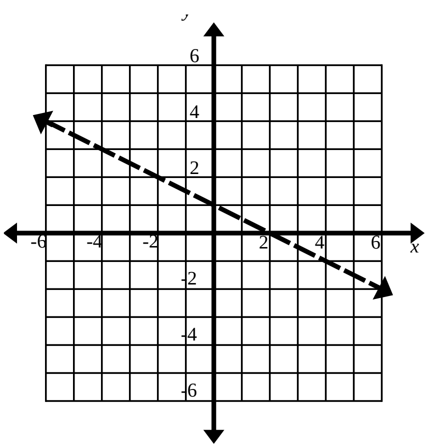
13) $-2x + 5y \ \square \ 15$



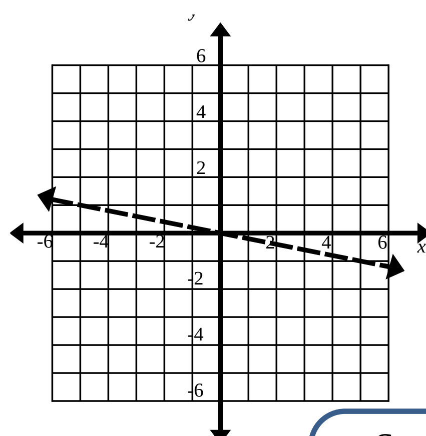
14) $9 \ \square \ 2x + 3y$



15) $2 \ \square \ x + 2y$



16) $x + 5y \ \square \ 0$

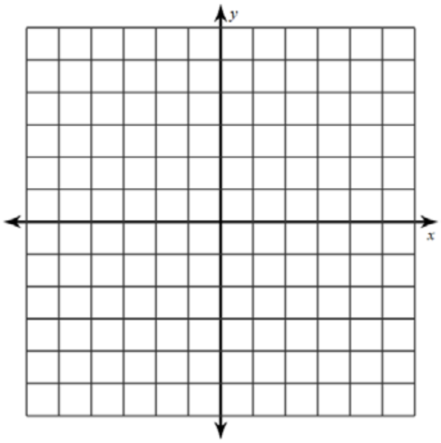


Section 1.1C

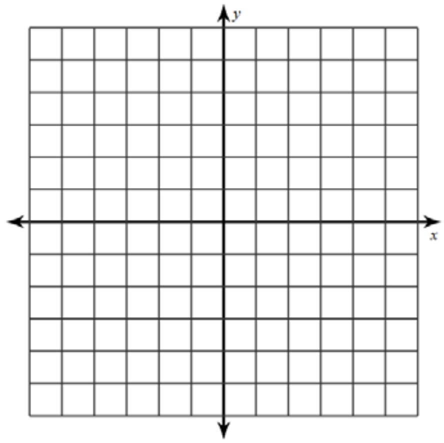
1.1D *Graphing Linear Inequalities in Any Form using Graphing Technology*

#1 – 3: Graph the following inequalities on a graphing calculator and draw the graph.

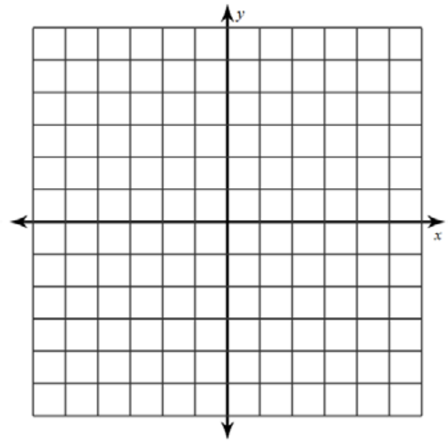
1) $y \le -\frac{1}{2}x + 4$



2) $y \ge 7x - 2$



3) $y > -\frac{9}{5}x - 4$



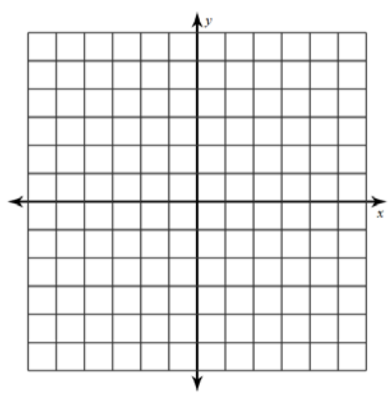
#4 – 9: For each of the following linear inequalities:

- **a)** Rewrite it in slope-intercept form
- **b)** Graph it on a graphing calculator or using graphing technology and draw the graph.
- **c)** Test a point that is shaded on the graphing calculator in the <u>original inequality</u> to verify.

4) $7x + 2y \le -6$

a)

b)

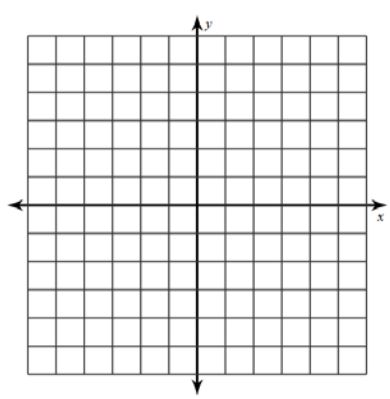


c)

5) $x - y > -2$

a)

b)



c)

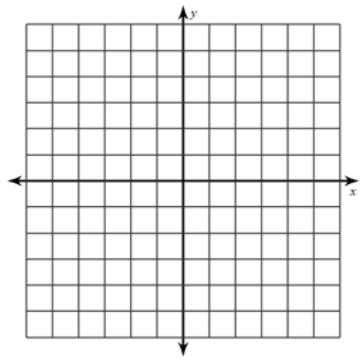
1.1D *Graphing Linear Inequalities in Any Form using Graphing Technology*

#4 – 9 (continued): For each of the following linear inequalities:

a) ***Rewrite in slope-intercept form*** **b) Graph *on technology* then draw here** **c)*Test a point in <u>original inequality</u>***

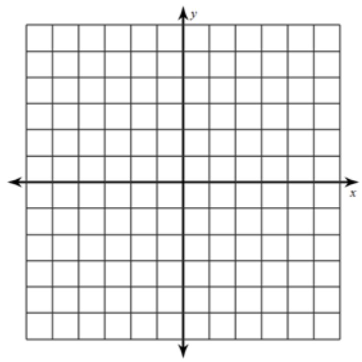
6) $4x + 3y > -9$

a) **b)** **c)**



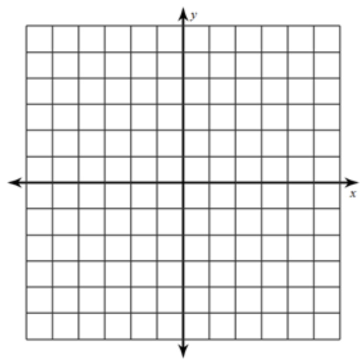
7) $6x - y < 5$

a) **b)** **c)**



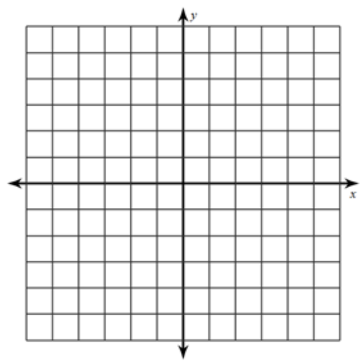
8) $2x - 5y < 0$

a) **b)** **c)**



9) $3x - 4y \le 4$

a) **b)** **c)**



1.1D *Graphing Linear Inequalities in Any Form using Graphing Technology*

10) The Coon Rapids girls' lacrosse team is having a bake sale to raise money for a team camp. They are selling cakes for $4 each and a bag of cookies for $2. Their goal is to sell $50 of cakes and cookies. Kassie and Krissy are both players on the team.

Kassie said, "I made a table (to the right) and noticed that we need to sell 2 fewer bags of cookies for every cake that we sell so the slope equals –2. I also saw that if we don't sell any cakes we need to sell 25 bags of cookies so the *y*-intercept is 25. So the inequality should be $y \geq -2x + 25$."

Cakes	Cookies
0	25
1	23
2	21
3	19

Krissy said, "I noticed that if *x* represents the number of cakes, then 4*x* would be the amount of money that we made with from cakes. If *y* represents the bags of cookies, then 4*y* would be the amount of money that we made from cookies. We want to make at least $50 so the inequality should be $4x + 2y \geq 50$.

Which player is correct, or are they both correct? Justify your answer.

Section 1.1D

1.1D *Graphing Linear Inequalities in Any Form using Graphing Technology*

This page intentionally left blank

1.2A Writing Equations and Inequalities

1) A library is trying to decrease the number of overdue books by increasing the fines. They plan to charge a flat fee of $2.25 for an overdue book and $0.10 for each day a book is overdue. Which equation shows the amount of a fine (*F*) for a book that is overdue for *d* days?

a) $F = -2.25d + 0.10$

b) $F = -0.10d + 2.25$

c) $F = 2.25d + 0.10$

d) $F = 0.10d + 2.25$

Justify which equation you chose and explain why the others are incorrect.

2) The number of people (*n*) who will attend a dance depends on the admission price (*p*), in dollars. This relationship is represented by the equation shown below.

$$n = 800 - 50p$$

Which of these is a correct interpretation of this equation?

a) The number of people attending the dance will increase by 50 for every dollar the admission price increases.

b) The number of people attending the dance will decrease by 50 for every dollar the admission price increases.

c) The minimum number of people attending the dance will be 800.

d) The maximum number of tickets that can be sold is 50.

Justify which statement you chose and explain why the others are incorrect.

3) The senior class is producing a play to raise money for graduation activities. They would like to earn at least $500. They intend to charge $2 for each student ticket, and $5 for each adult ticket. Define the variables and write an inequality that represents this situation.

4) Several times a week a student runs part of the way and walks part of the way on a trail that is less than 4 miles long. The student's running speed is 6 miles per hour and her walking speed is 4 miles per hour. Define the variables and write an inequality that represents this situation.

5) Satchi found a used bookstore that sells pre-owned videos and CDs. Videos cost $9 each, and CDs cost $7 each. Satchi can spend no more than $35.

a) Define the variables and write an inequality that represents this situation.

b) Does Satchi have enough money to buy 2 videos and 3 CDs?

6) The perimeter of a rectangular lot is less than 800 feet. Define the variables and write an inequality that represents the amount of fencing that will enclose the lot.

1.2A *Writing Equations and Inequalities*

7) At a grocery store the price of a lemon is \$0.50 and the price of a lime is \$0.25. Define the variables and write an inequality to model the relationship between the number of lemons and the number of limes that can be purchased for less than \$5.00.

8) You have \$4000 to buy stock and have decided on The Clothes Store (TCS) and United Computers (UC). TCS sells for \$20 per share and UC sells for \$15 per share. Define the variables and write an inequality which restricts the purchase of x shares of TCS and y shares of UC.

9) Tickets for the school play cost \$5 per student and \$7 per adult. The school wants to earn at least \$5400 on each performance.

a) Define the variables and write an inequality that represents this situation.

b) If 500 adult tickets are sold, what is the minimum number of student tickets that must be sold?

10) A fast food restaurant charges \$11.00 for a Pizza and \$4.00 for wings. The basketball team has no more than \$100 to spend on pizza and wings for their post-game celebration.

a) Define the variables and write an inequality that represents this situation.

b) Determine if the team can purchase 8 pizzas and 6 orders of wings. Show your thinking.

1.2A *Writing Equations and Inequalities*

11) An auto parts company can produce 525 four–cylinder engines or 270 V–6 engines per day. It wants to produce up to 300,000 engines per year. There are 250 work days per year (this is not counting weekend days). Define the variables and write an inequality that represents this situation.

12) A moving van has an interior height of 7 feet (84 inches). You have boxes in 12 inch and 15 inch heights, and want to stack them as high as possible to fit. Define the variables and write an inequality that represents this situation.

13) The grocery store has grapes that sell for $2.25 a pound and oranges that sell for $1.90 a pound. Define the variables and write an inequality that represents how much of each type of fruit can be bought with no more than $20.

14) A wholesaler has $80,000 to spend on certain models of mattress sets and bed frames. If the mattress sets may be obtained at $200 each and the bed frames at $100 each, define the variables and write an inequality that restricts the purchase on x mattress sets and y bed frames.

Section 1.2A

1.3A *Modeling Real-World Situations with Equations and Inequalities*

#1 – 8: Address each statement presented or answer each question that is asked.

1) Fuel x costs \$2 per gallon and fuel y costs \$3 per gallon. You have at most \$18 to spend on fuel.

a) Identify the variables for this situation.

b) Write an inequality to represent the amount of **money** you can spend on fuel x and fuel y.

2) A salad contains ham and chicken. There are at most 6 pounds of ham and chicken in the salad.

a) Identify the variables for this situation.

b) Write an inequality to represent the amount of ham and chicken in the salad.

3) Mary babysits for \$4 per hour. She also works as a tutor for \$7 per hour. She is only allowed to work 13 hours per week. She wants to make at least \$65.

a) Identify the variables for this situation.

b) Write an inequality that shows the amount of **time** that you want to spend at work.

c) Write an inequality that shows the amount of **money** that that you want to earn from work.

4) You can work a total of no more than 41 hours each week at your two jobs. Housecleaning pays \$5 per hour and your sales job pays \$8 per hour. You need to earn at least \$254 each week to pay your bills.

a) Identify the variables for this situation.

b) Write an inequality that shows the amount of **time** that you want to spend at work.

c) Write an inequality that shows the amount of **money** that that you want to earn from work.

#1 – 8 (continued): Address each statement presented or answer each question that is asked.

5) You manufacture cell phone accessories: cases and clips. You need to produce at least 40 cases each day. You have to produce at least 20 clips each day. Due to time constraints we can produce no more than 80 items total in a day. You make a profit of $6 for each case sold and $4 for each clip sold.

Let c = the number of cases produced and p = the number of clips produced

a) Write an equation for the anticipated profit.

b) Write an inequality that shows how many cases you have to produce each day.

c) Write an inequality that shows how many clips you have to produce each day.

d) Write an inequality that represents the time constraint for the total number of clips and cases sold.

6) The automotive plant in Rockaway makes the Topaz and the Mustang. The plant has a maximum production capacity of 1200 cars per week. During the spring, a dealer orders up to 600 Topaz cars and 800 Mustangs each week. The profit on a Topaz is $500 and on a Mustang it is $800.

a) Write an equation for the anticipated profit.

b) Write an inequality that shows how many total cars are produced per week.

c) Write an inequality that shows how many Topaz are ordered per week.

d) Write an inequality that shows how many Mustangs are ordered per week

#1 – 8 (continued): Address each statement presented or answer each question that is asked.

7) A wii manufacturer is making wii remotes and wii nunchucks. For each wii remote sold they make $20 profit. For each wii nunchuck sold they make $12 profit. The wii remotes take 4 hours to prepare the parts and 1 hour to assemble. The wii nunchuck takes 2.5 hours to prepare the parts and 2.5 hours to assemble. The maximum preparation time available is 16 hours. The maximum assembly time available is 10 hours. Write a system of inequalities, be sure to identify and define variables. Write an equation to be used to maximize the profit.

a) Organize the given information in a chart or a table.

	Remotes	Nunchucks	Total
Prep Time			
Assembly Time			
Profit			

b) Identify the variables.

c) Determine the objective function used to maximize the profit.

d) Write the constraints as a system of inequalities.

Include inequalities for prep time, for assembly time and ones that indicate that neither the number of remotes nor the number of nunchucks can be negative.

#1 – 8 (continued): Address each statement presented or answer each question that is asked.

8) A manufacturer of ski clothing makes ski pants and ski jackets. The profit on a pair of ski pants is $2.00 and on a jacket is $1.50. Both pants and jackets require the work of sewing operators and cutters. There are 60 minutes of sewing operator time and 48 minutes of cutter time available. It takes 8 minutes to sew one pair of ski pants and 4 minutes to sew one jacket. Cutters take 4 minutes on pants and 8 minutes on a jacket. Find the maximum profit and the amount of pants and jackets to maximize the profit.

a) Organize the given information in a chart or a table.

b) Identify the variables.

c) Determine the objective function used to maximize the **profit**.

d) Write the constraints as a system of inequalities.

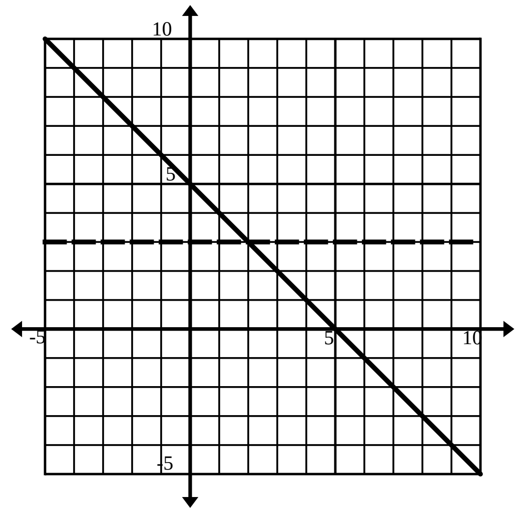
Include inequalities for sewing time, cutting time and ones that that indicates that neither the number of ski pants nor ski jackets can be negative.

Section 1.3A

1.3B *Graphing Systems of Linear Inequalities to Find a Feasible Region*

1) How do we know if a point is part of the feasible region?

2) Look at the following graph. Determine whether the following points are a solution to the system and explain why or why not.



a) $(-3, 2)$

b) $(-4, 2)$

c) $(5, 0)$

d) $(0, 3)$

#3 – 8: Match each system of inequalities with its graph.

3) $y \ge -x$; $y \ge -3$; $x \le 2$

4) $y \le -x$; $y \ge -3$; $x \le 2$

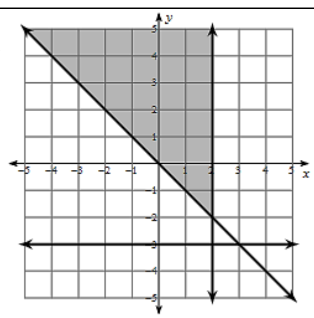
5) $x + y \ge 2$; $2x - 3y > 1$

6) $x + y \ge 2$; $2x - 3y < 1$

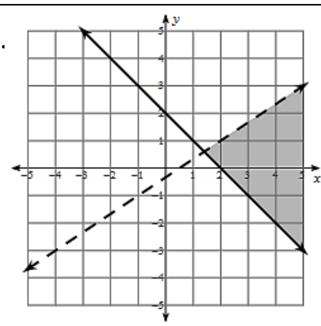
7) $y \le -2x + 3$; $y \ge \frac{1}{2}x - 3$; $x \ge -2$

8) $y \ge -2x + 3$; $y \ge \frac{1}{2}x - 3$; $x \ge -2$

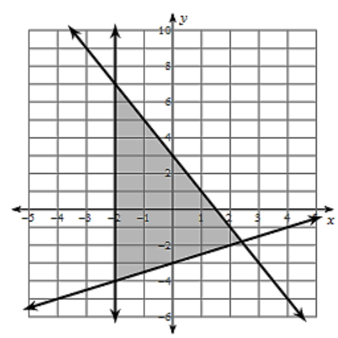
A.



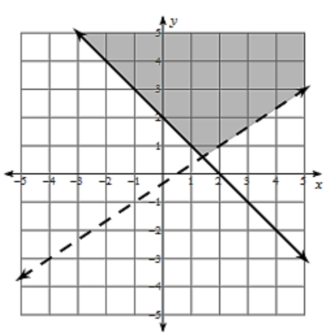
B.



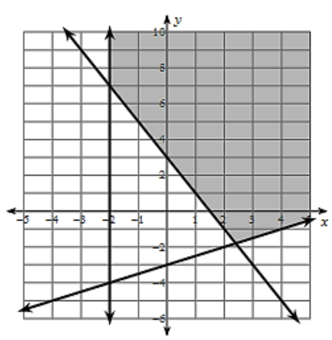
C.



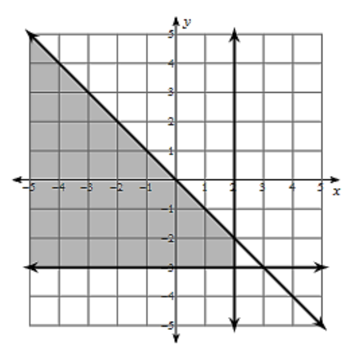
D



E.



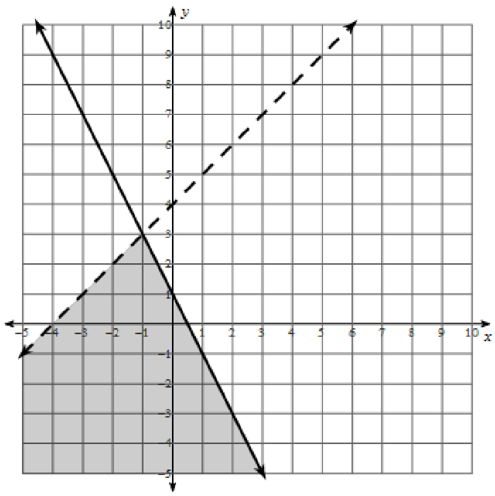
F.



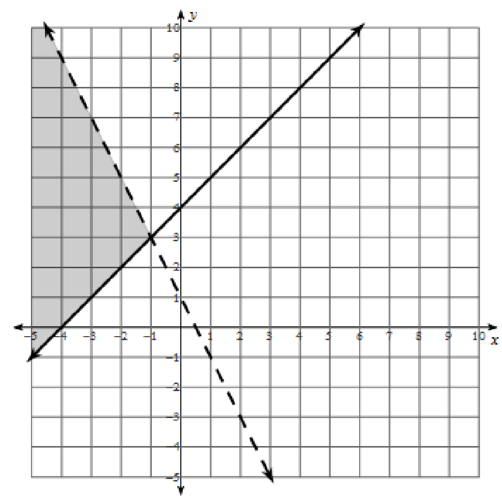
9) Tina and Boyang both graphed the following system of equations to find the feasible region. Did either of them do the problem correctly? If not explain to them what they did wrong and show the correct solution.

$$\begin{cases} y < x + 4 \\ y \geq -2x + 1 \end{cases}$$

Tina



Boyang



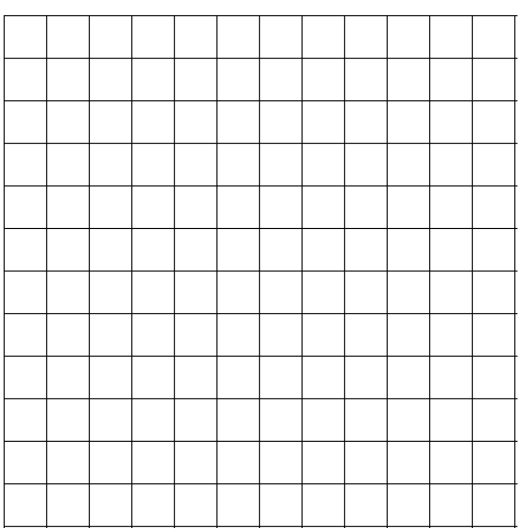
#10 – 13: Graph the system of inequalities to find the feasible region.

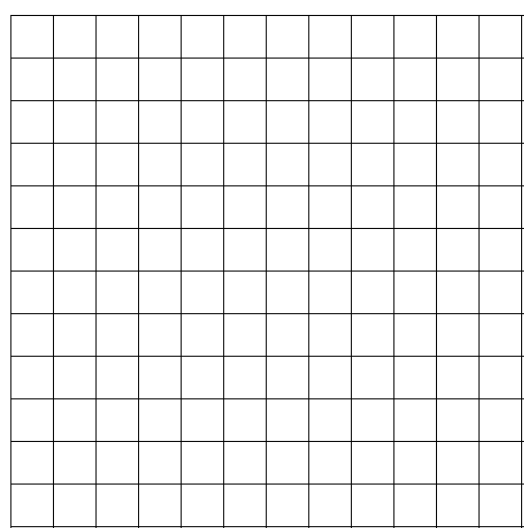
10) $\begin{cases} y > -2 \\ x \leq 3 \\ x + y < 5 \end{cases}$

x	y	x	y	x	y

11) $\begin{cases} x - y < -6 \\ 2y \geq 3x + 17 \end{cases}$

x	y	x	y





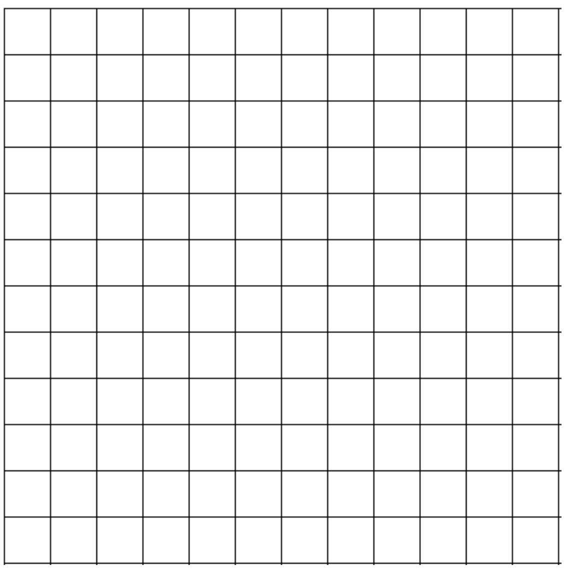
1.3B *Graphing Systems of Linear Inequalities to Find a Feasible Region*

#10 – 13 (continued): Graph the system of inequalities to find the feasible region.

12) $\begin{cases} 5x - y \geq 5 \\ 2y - x \geq -10 \end{cases}$

x	*y*

x	*y*

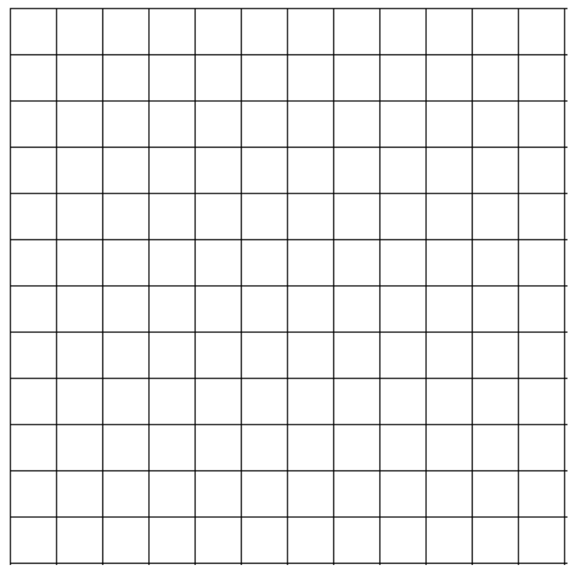


13) $\begin{cases} 5x + 2y \leq -24 \\ 3x - 2y \leq 16 \\ x - 6y \geq 12 \end{cases}$

x	*y*

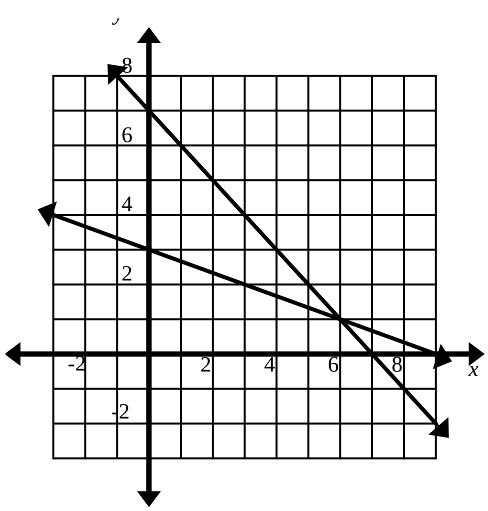
x	*y*

x	*y*

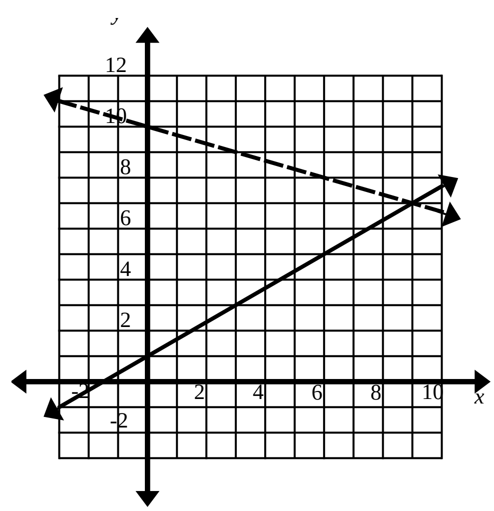


#14 – 15: Write the system of inequalities that would create each graph.

14)

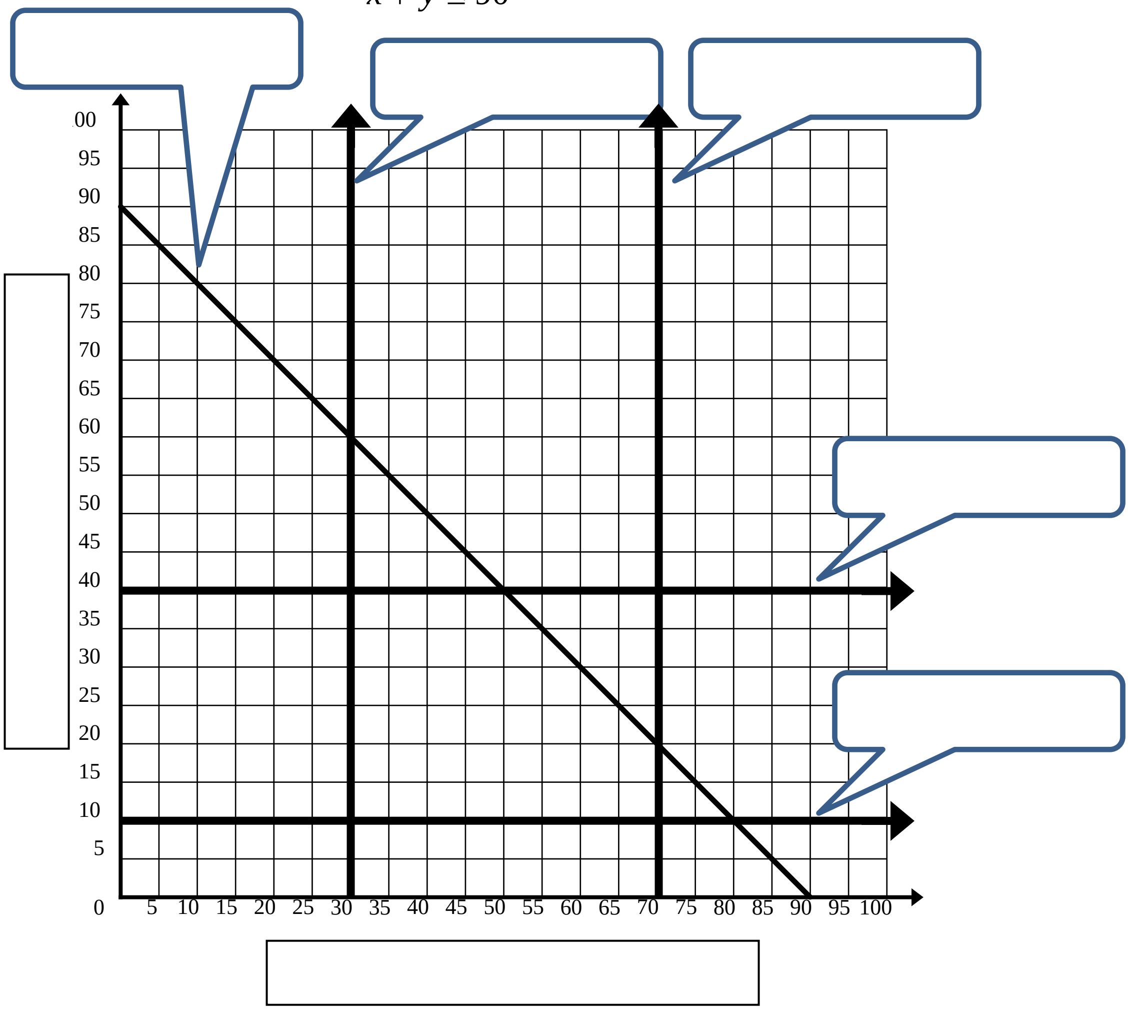


15)



16) A local street vendor sells hotdogs and pretzels. To make a profit, the street vendor must sell at least 30 hotdogs but cannot prepare more than 70. The street vendor must also sell at least 10 pretzels but cannot prepare more than 40. The street vendor cannot prepare more than a total of 90 hotdogs and pretzels altogether. The profit is \$0.48 on a hotdog and \$0.25 on a pretzel.

$$x \geq 30 \qquad x \leq 70$$
$$y \geq 10 \qquad y \leq 40$$
$$x + y \leq 90$$



a) Jane forgot to define her variables. What do ***x*** and ***y*** represent? Label the axes.

b) Within each "callout box", label each line with its inequality.

c) Shade the feasible region.

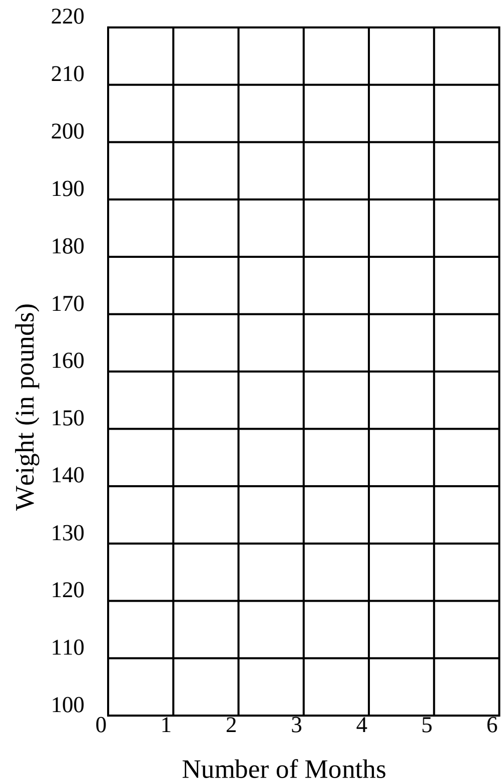
d) Is it possible for the vendor to sell 5 pretzels and 60 hotdogs? Record your thinking.

Section 1.3B

e) Can the vendor sell 30 pretzels and 40 hotdogs? Record your thinking.

1.3C *Linear Programming – Finding Vertices Graphically*

1) Wayne and Bubba both play football. The team trainer has put them each on their own special healthy diet. Wayne currently weighs 120 lbs. The trainer puts him on a special bulk-up plan to gain 10 lbs per month. Bubba currently weighs 210 lbs. The trainer puts him on a special get-lean plan to lose 8 lbs per month.



a) Make a table of values that represents Wayne's weight and Bubba's weight for 6 months.

Wayne's weight

Bubba's weight

b) Make a graph that represents Wayne's weight for the 6 month time period.

c) Make a graph that represents Bubba's weight for the 6 month time period.

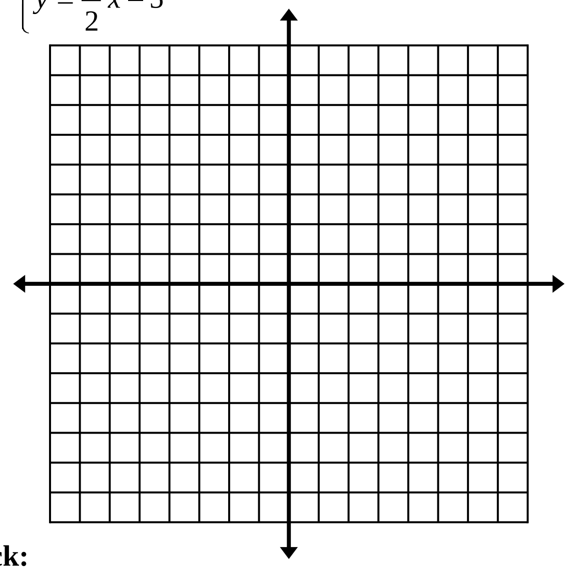
d) Find the point where the lines intersect.

e) Explain the meaning of the point of intersection.

1.3C *Linear Programming – Finding Vertices Graphically*

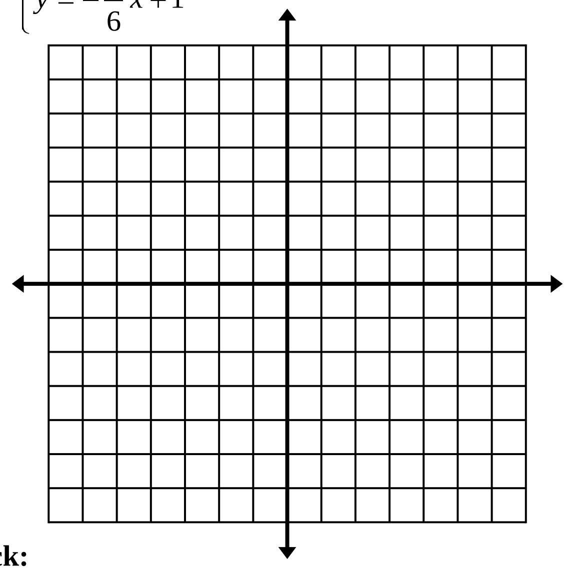
#2 – 5: Solve the systems of equations by graphing. Check your solution by showing that it works in each equation.

2) $\begin{cases} y = \dfrac{7}{2}x + 1 \\ y = \dfrac{1}{2}x - 5 \end{cases}$ solution: (_____, _____)



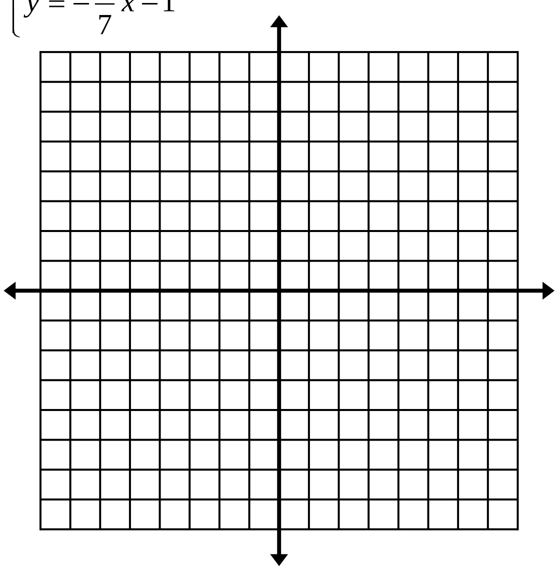
Check:

3) $\begin{cases} y = \dfrac{1}{6}x + 7 \\ y = -\dfrac{5}{6}x + 1 \end{cases}$ solution: (_____, _____)



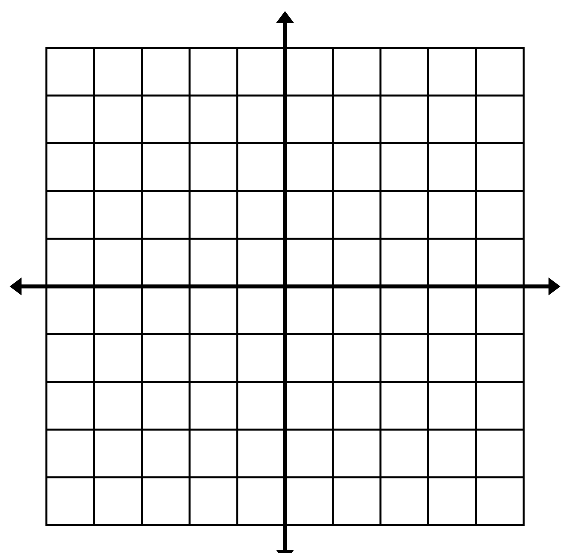
Check:

4) $\begin{cases} y = -\dfrac{2}{7}x - 5 \\ y = -\dfrac{2}{7}x - 1 \end{cases}$ solution: ____________



Check:

5) $\begin{cases} x - 2y = -4 \\ 3x + 2y = -4 \end{cases}$ solution: ____________

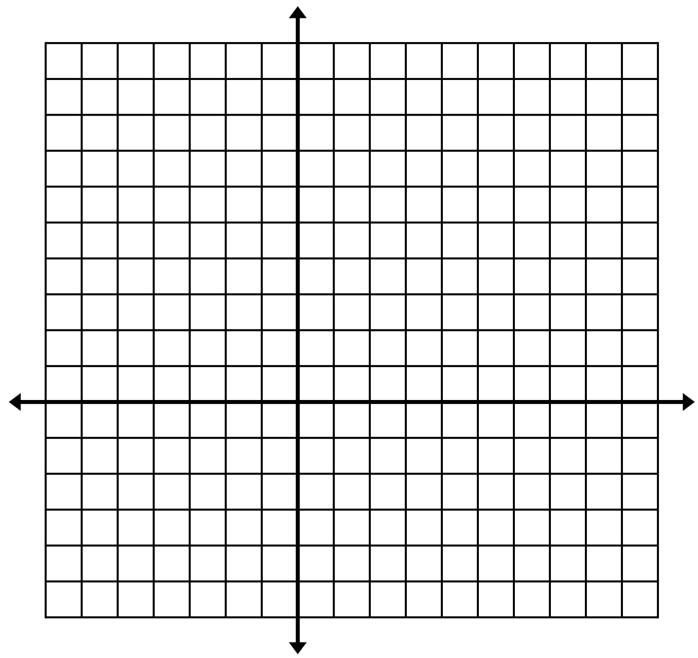


Check:

1.3C *Linear Programming – Finding Vertices Graphically*

6) Graph the system of inequalities. Find the vertices of the feasible region and label them on the graph.

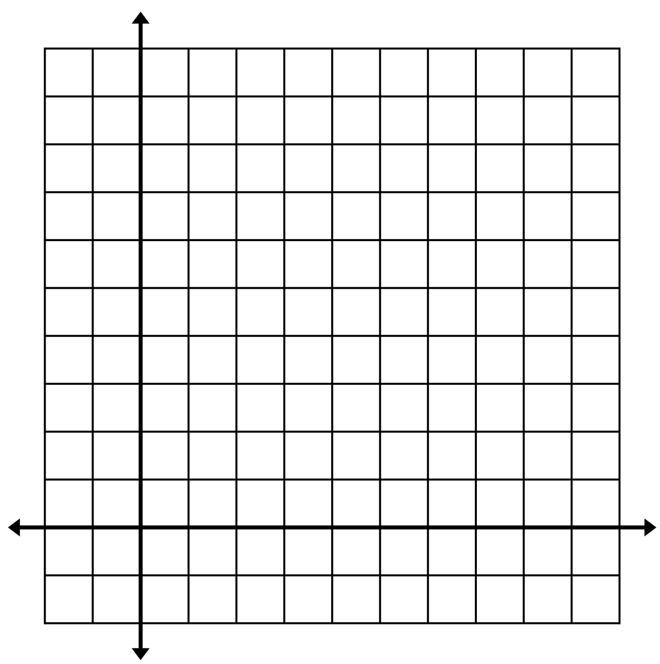
$$\begin{cases} y \geq -x - 2 \\ y \leq 2x + 1 \\ y \leq \dfrac{1}{2}x + 7 \end{cases}$$



VERTICES:

7) Graph the system of inequalities. Find the vertices of the feasible region and label them on the graph.

$$\begin{cases} 2x + y \geq 10 \\ x \geq 1 \\ y \geq 2 \\ y \geq -x + 7 \end{cases}$$



VERTICES:

1.3C *Linear Programming – Finding Vertices Graphically*

8) A farmer has 10 acres to plant in wheat and rye. He has to plant at least 7 acres. However, he has only \$1200 to spend and each acre of wheat costs \$200 to plant and each acre of rye costs \$100 to plant. Moreover, the farmer has to get the planting done in 12 hours and it takes an hour to plant an acre of wheat and 2 hours to plant an acre of rye. The profit is \$500 per acre of wheat and \$300 per acre of rye.

a) Identify the variables and label the axes.

b) Determine the objective function used to maximize the profit.

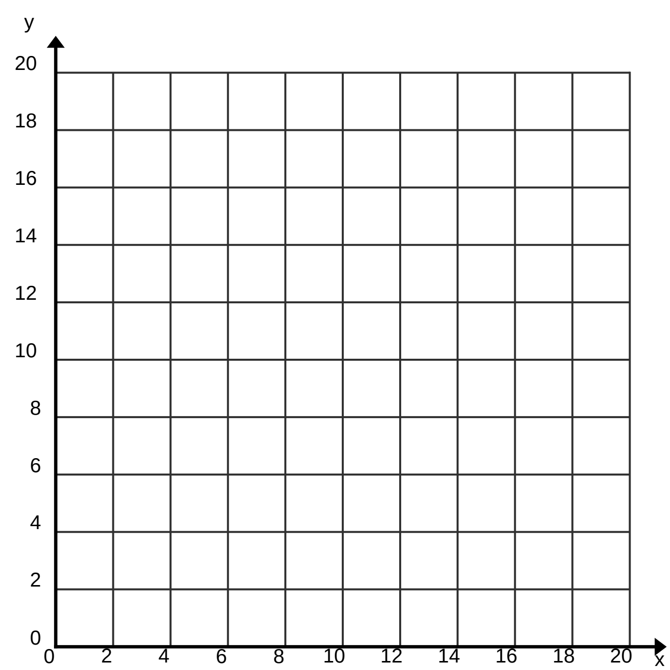
c) Write the constraints as a system of inequalities.

Acres:

Cost:

Time:

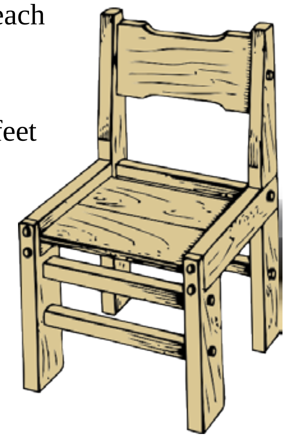
d) Graph the feasible region on the graph below. Find (and list) the vertices of the feasible region and label them on the graph.



VERTICES:

1.3C *Linear Programming – Finding Vertices Graphically*

9) A carpenter makes tables and chairs. Each table can be sold for a profit of $30 and each chair for a profit of $10. The carpenter can afford to spend up to 42 hours per week working and takes six hours to make a table and three hours to make a chair. The carpenter has a small shop and has limited room for storage. He has only 40 cubic feet available for storage. Chairs take 5 cubic feet of storage; fortunately the tables are collapsible and only take 4 cubic feet of storage.



a) Identify the variables and label the axes**.**

b) Determine the objective function used to maximize the profit.

c) Write the constraints as a system of inequalities.

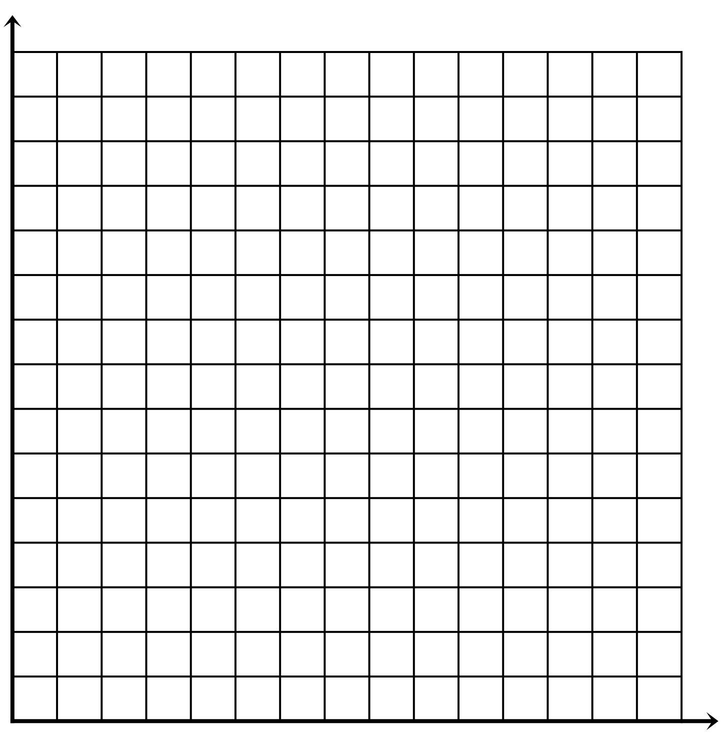
Minimum number of tables:

Minimum number of chairs:

Time available:

Storage available:

d) Graph the constraints on the grid. Find (and list) the vertices of the feasible region and label them on the graph.



VERTICES:

Section 1.3C

This page intentionally left blank

1.3D *Linear Programming – Finding Vertices Algebraically*

#1 – 4: Solve the systems of equations by <u>elimination</u> and check to see that it works for both equations.

1) $\begin{cases} 3x+8y=-18 \\ -7x-8y=10 \end{cases}$ solution:__________

2) $\begin{cases} 10x-3y=-25 \\ 5x-9y=25 \end{cases}$ solution:__________

3) $\begin{cases} -9x+4y=-13 \\ 3x-8y=11 \end{cases}$ solution:__________

4) $\begin{cases} 8x+6y=16 \\ x-3y=17 \end{cases}$ solution:__________

5) Jack and Jill went Taco Bell for lunch. Jack ordered three tacos and three burritos for lunch and his bill totaled $11.25. Jill paid $6.25 for one taco and two burritos.

a) Write an equation to represent Jack's lunch order.

b) Write an equation to represent Jill's lunch order.

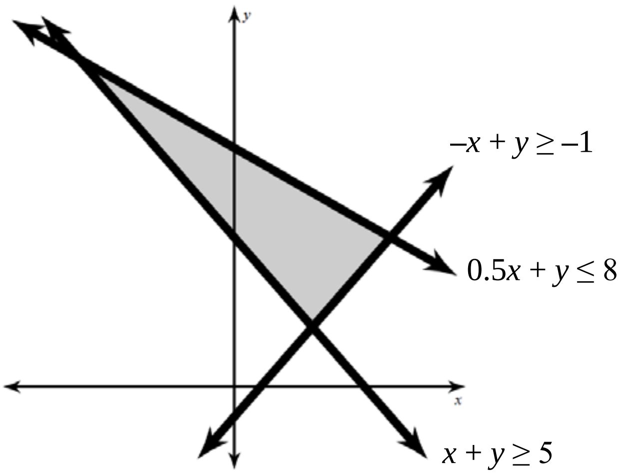
c) Use the **elimination** method to find the amount that each taco cost and each burrito cost.

d) How do you know your answer is correct?

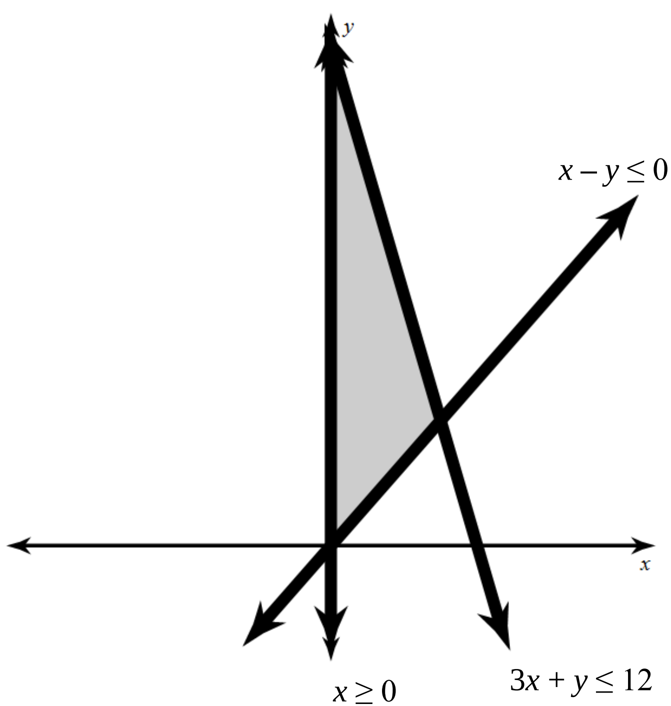
1.3D *Linear Programming – Finding Vertices Algebraically*

#6 – 9: Use <u>elimination</u> to find each vertex of the feasible region graphed below. Label each vertex.

6)

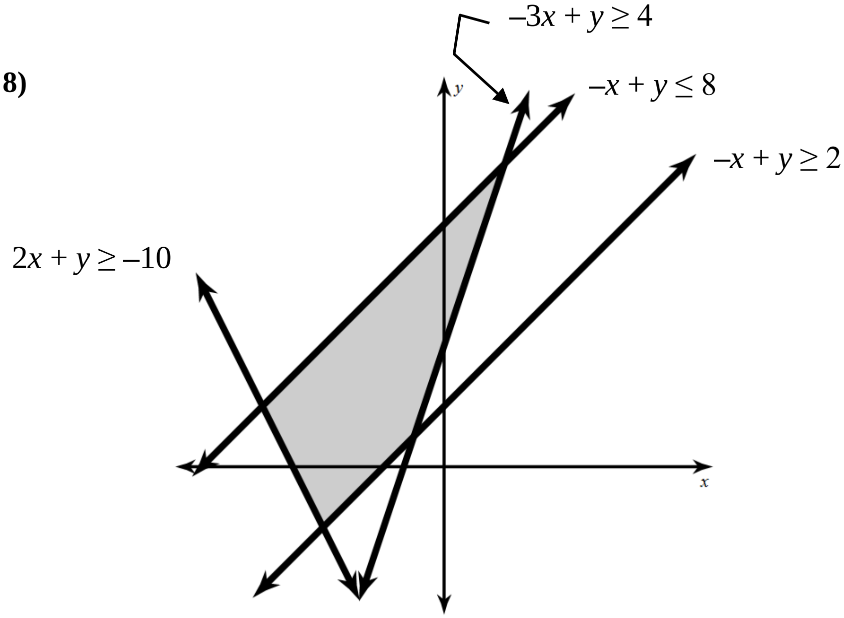


7)

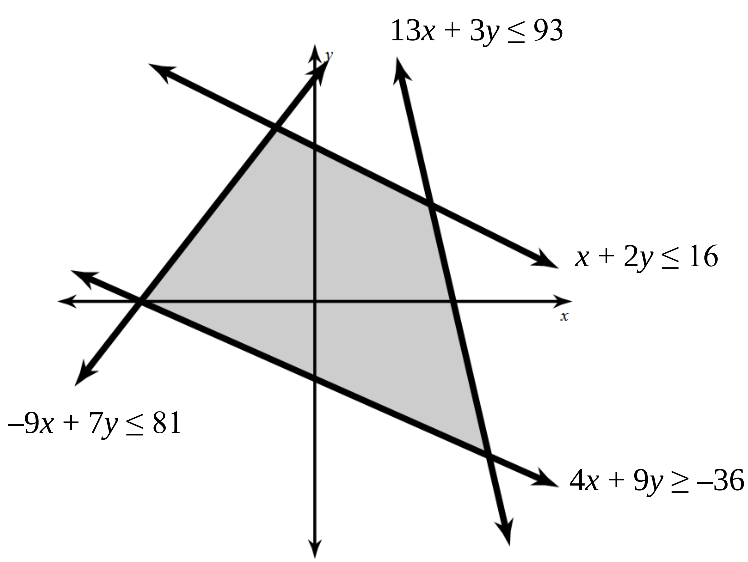


#6 – 9 (continued): Use <u>elimination</u> to find each vertex of the feasible region graphed below. Label each vertex.

8)



9)



1.3D *Linear Programming – Finding Vertices Algebraically*

10) A shoe company makes basketball and soccer shoes using two machines (A and B). Each pair of basketball shoes that are produced requires 50 minutes processing time on machine A and 30 minutes processing time on machine B. Each pair of soccer shoes that are produced requires 24 minutes processing time on machine A and 33 minutes processing time on machine B.

At the start of the current week there are 30 pairs of basketball shoes and 90 pairs of soccer shoes in stock. Available processing time on machine A is forecast to be 40 hours (2400 minutes) and on machine B is forecast to be 33 hours (1980 minutes).

The profit for a pair of basketball shoes in the current week is $75 and for a pair of soccer shoes is $95. Company policy is to maximize the profits.

a) Identify the variables and label the axes.

b) Determine the objective function used to maximize the profit.

c) Write the constraints as a system of inequalities.

Machine A Time:

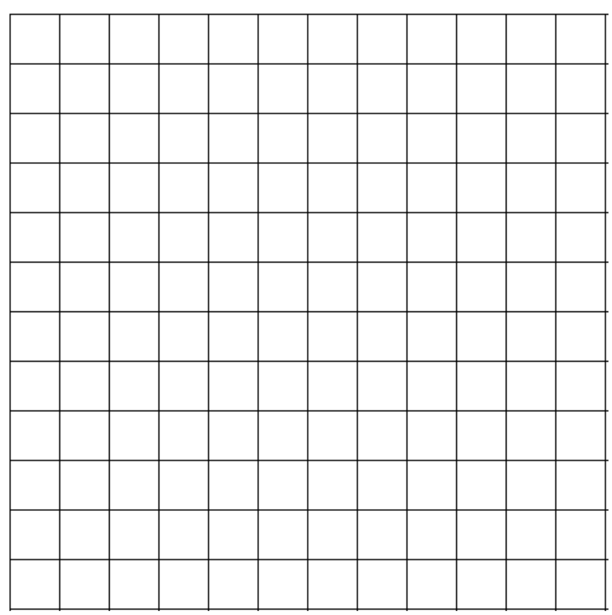
Machine B Time:

# of Pairs of Basketball Shoes:

# of Pairs of Soccer Shoes:

d) Graph the constraints on the grid. Find (and list) the vertices of the feasible region and label them on the graph.

VERTICES:



1.3D *Linear Programming – Finding Vertices Algebraically*

11) A potter is making cups and plates. It takes her 6 minutes to make a cup and 3 minutes to make a plate. Each cup uses 3/4 lb. of clay and each plate uses one lb. of clay. She has 20 hours available for making the cups and plates and has 250 lbs. of clay on hand. She makes a profit of $2 on each cup and $1.50 on each plate.

a) Identify the variables and label the axes.

b) Determine the objective function.

c) Write the constraints as a system of inequalities.

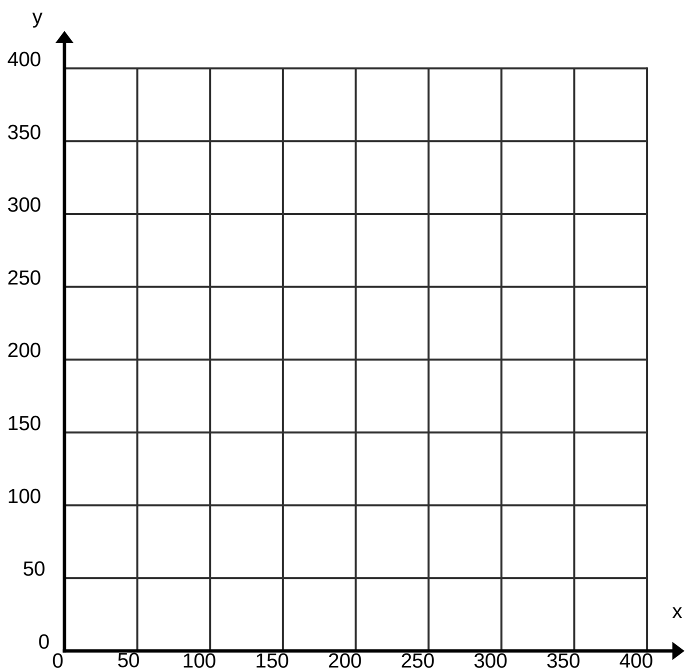
Minimum number of cups:

Minimum number of plate:

Time available:

Clay available:

d) Graph the feasible region on the graph below. Use elimination to find the vertices.



VERTICES:

1.3D *Linear Programming – Finding Vertices Algebraically*

#12 – 15: Solve the systems of equations by <u>substitution</u> and check to see that it works for both equations.

12) $\begin{cases} y = -7x - 1 \\ y = -6x - 2 \end{cases}$ solution: ____________

13) $\begin{cases} y = 3x - 5 \\ y = -7x - 5 \end{cases}$ solution: ____________

14) $\begin{cases} y = x - 7 \\ 3x + 5y = -19 \end{cases}$ solution: ____________

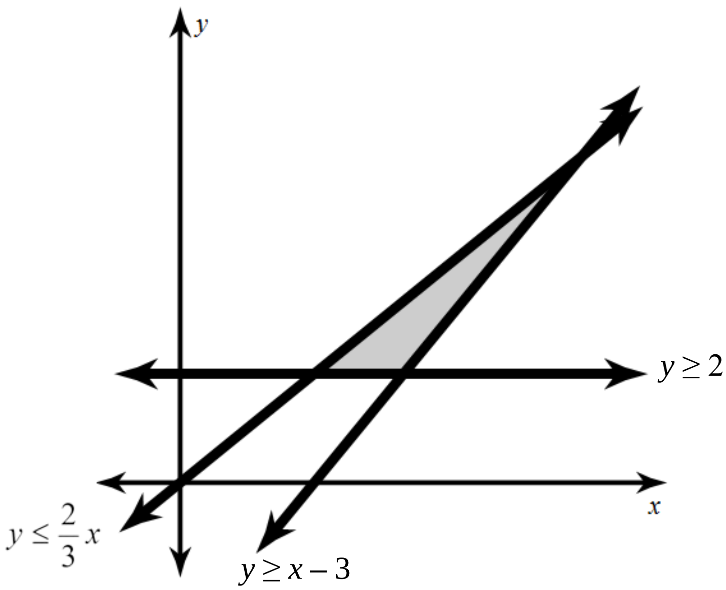
15) $\begin{cases} -3x + 6y = -9 \\ y = 2x + 3 \end{cases}$ solution: ____________

16) An amusement park charges admission plus a fee for each ride. Admission plus two rides costs $10. Admission plus five rides cost $16. What is the charge for admission and the cost of a ride?

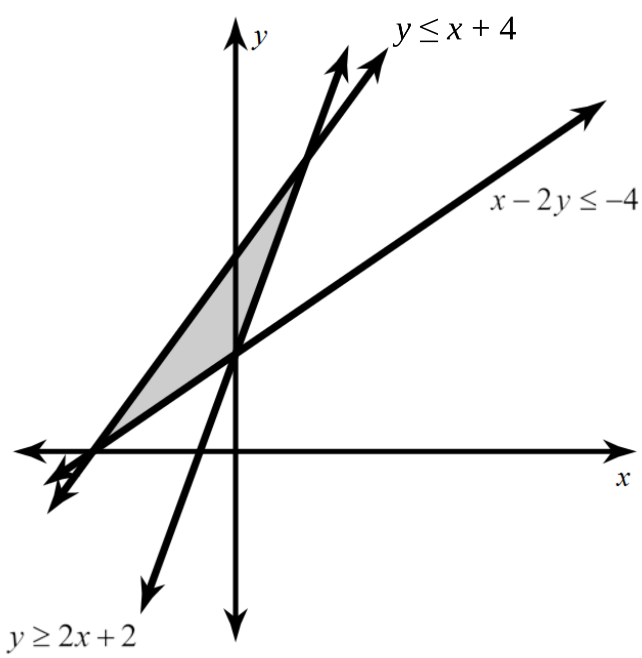
1.3D *Linear Programming – Finding Vertices Algebraically*

#17 – 20: Use <u>substitution</u> to find each vertex of the feasible region graphed below. Label each vertex.

17)

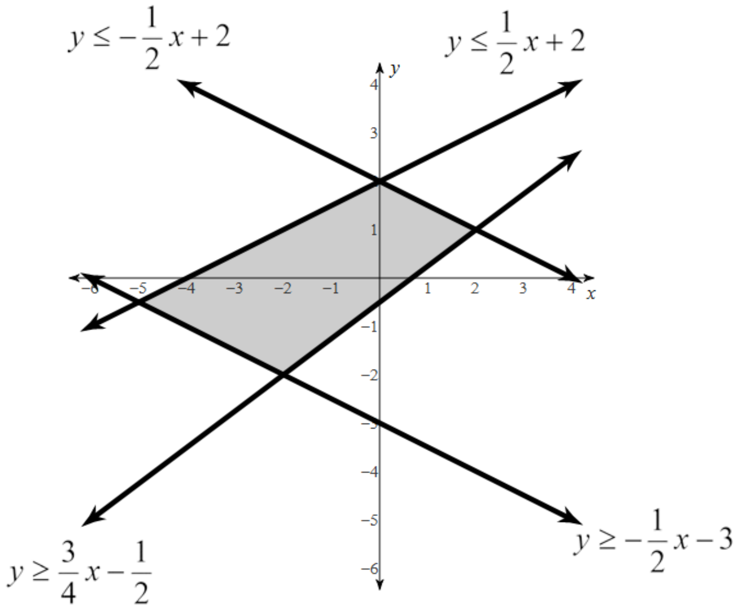


18)

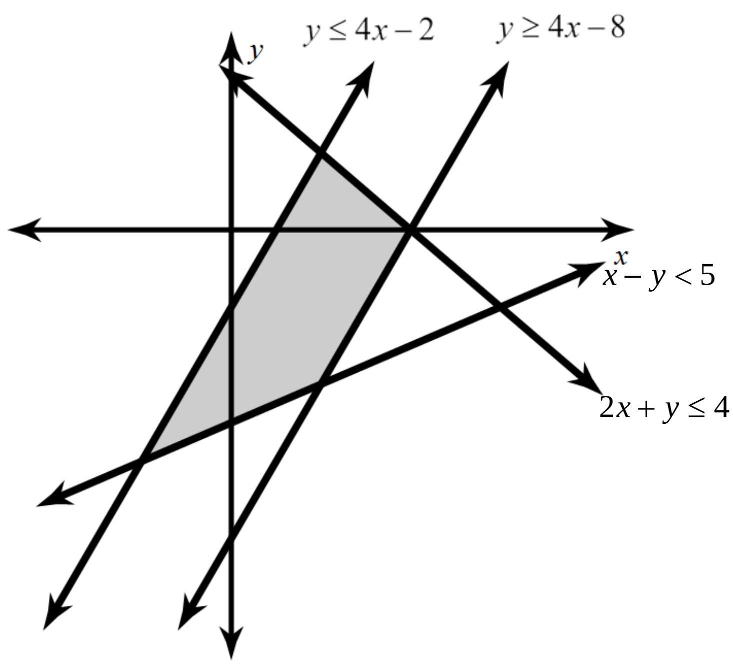


#17 – 20 (continued): Use <u>substitution</u> to find each vertex of the feasible region graphed below. Label each vertex.

19)



20)



1.3D *Linear Programming – Finding Vertices Algebraically*

21) The Northern Wisconsin Paper Mill can convert wood pulp to either notebook paper or newsprint. The mill can produce at most 200 units of paper a day. At least 10 units of notebook paper and 80 units of newspaper are required daily by regular customers. The profit on a unit of notebook paper is $500 and the profit on a unit of newsprint is $350.

a) Identify the variables and label the axes.

b) Determine the objective function used to maximize the profit.

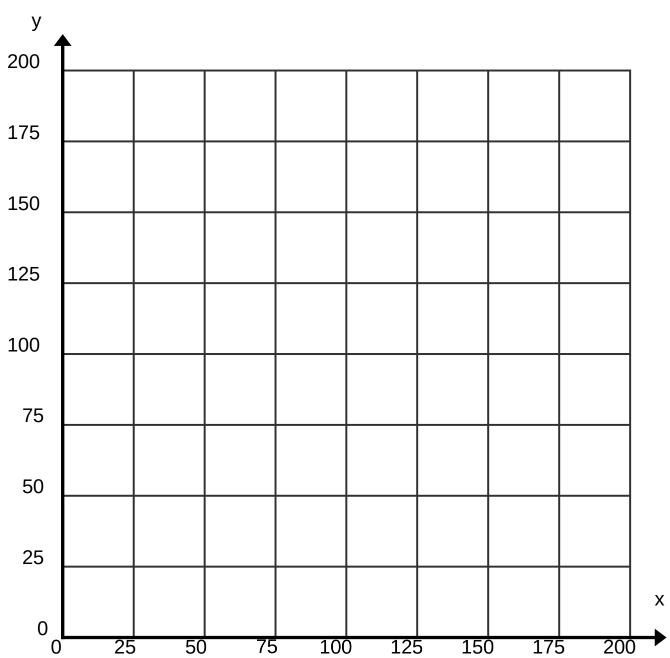
c) Write the constraints as a system of inequalities.

Minimum Notebook:

Minimum newsprint:

Production limit:

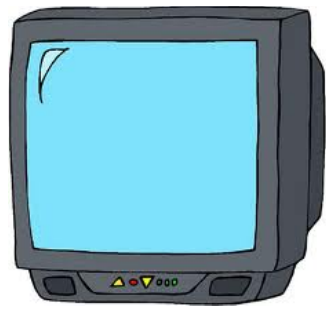
d) Graph the feasible region on the graph below. Use substitution to find the vertices.



VERTICES:

1.3D *Linear Programming – Finding Vertices Algebraically*

22) TeeVee Electronics, Inc., makes console and wide-screen televisions. The equipment in the factory allows for making at most 450 console televisions and 200 wide-screen televisions in one month. It costs $600 per unit to make a console television and $900 per unit to make a wide screen television. During the month of November, the company can spend $360,000 to make these televisions. TeeVee makes $125 profit on console television and $200 on widescreens.



a) Identify the variables and label the axes.

b) Determine the objective function.

c) Write the constraints as a system of inequalities.

Minimum Console:

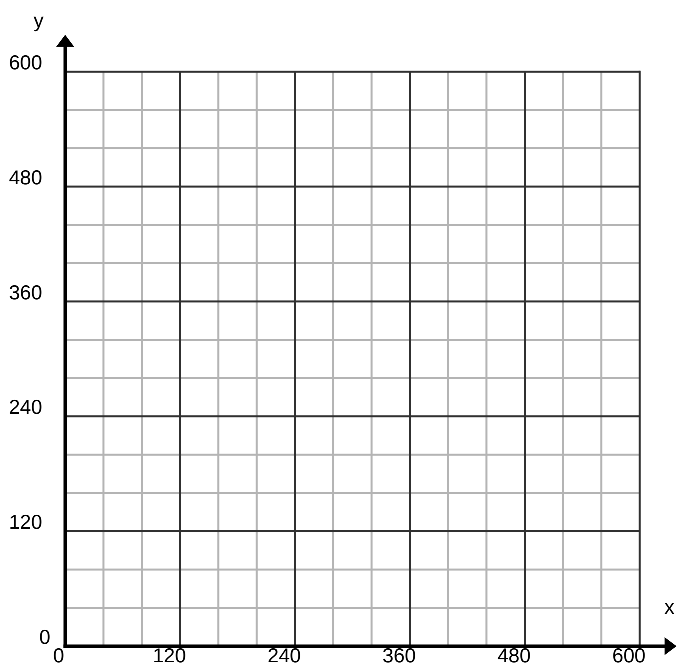
Minimum Wide Screens:

Maximum Consoles:

Maximum Wide Screens:

Costs:

d) Graph the feasible region on the graph below. Use substitution to find the vertices.



VERTICES:

1.3D *Linear Programming – Finding Vertices Algebraically*

23) A farmer has a 320 acre farm on which she plants two crops: corn and soybeans. For each acre of corn planted, her expenses are $50 and for each acre of soybeans planted, her expenses are $100. Each acre of corn requires 100 bushels of storage and yields a profit of $60; each acre of soybeans requires 40 bushels of storage and yields a profit of $90. The total amount of storage space available is 19,200 bushels and the farmer has only $20,000 on hand.

a) Identify the variables and label the axes.

b) Determine the objective function.

c) Write the constraints as a system of inequalities.

Minimum corn:

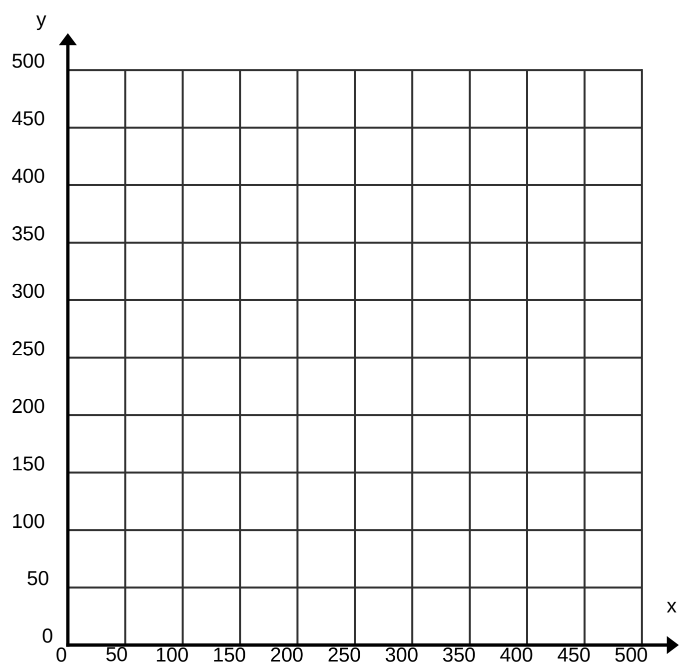
Minimum soybeans:

Acres available:

Expenses:

Storage:

d) Graph the feasible region on the graph below. Use substitution to find the vertices.



VERTICES:

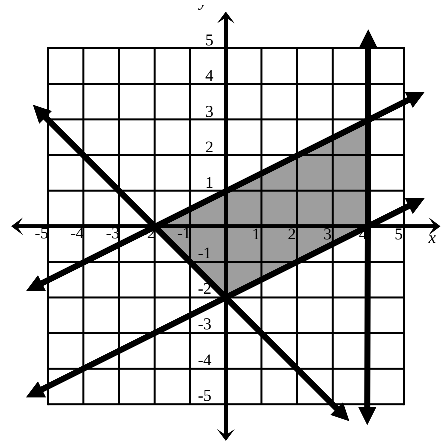
Section 1.3D

This page intentionally left blank

1.3E *Solving Linear Programming Problems*

1) Given the graph of the constraints and the objective function, determine the vertices of the feasible region, the values of the objective function and the maximum and minimum values.

a) $C = 2x + 3y$



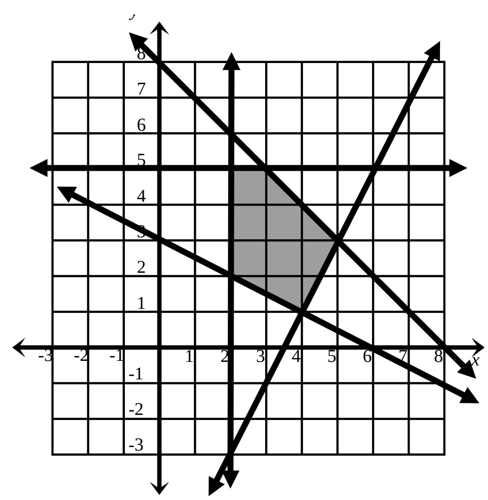
i) Find and list the vertices of the feasible region.

ii) Test each one of the vertices to determine the maximum and minimum values of the objective function.

Ordered pair	Calculations	Value

iii) Summarize your findings by identifying the maximum and minimum values of the objective function and the ordered pair that created each significant value.

b) $C = 3x + 6y$



i) Find and list the vertices of the feasible region.

ii) Test each one of the vertices to determine the maximum and minimum values of the objective function.

Ordered pair	Calculations	Value

iii) Summarize your findings by identifying the maximum and minimum values of the objective function and the ordered pair that created each significant value.

1.3E *Solving Linear Programming Problems*

2) Given the following objective function and the vertices of the feasible region, determine the maximum and minimum values.

Objective function: $C = 3x + y$

Vertices: (3, 0), (4, 5), (–1, 6), (–7, 5)

3) Given the constraints and the objective function:

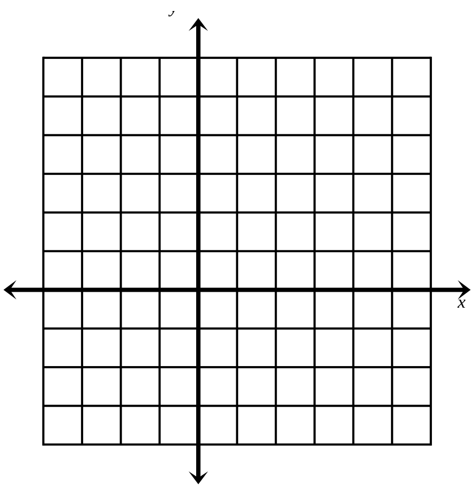
i) Graph the constraints.

ii) Find the vertices of the feasible region.

iii) Summarize your findings by identifying the maximum and minimum values of the objective function and the ordered pair that created each significant value.

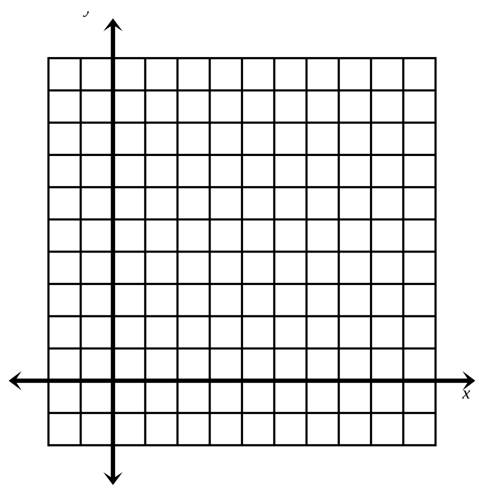
a) $\begin{cases} x \le 5 \\ y \le 4 \\ x + y \ge 2 \end{cases}$

Objective function: $C = 3x - 2y$



b) $\begin{cases} 2x + y \le 18 \\ x + 2y \le 12 \\ x \ge 1 \\ y \ge 4 \end{cases}$

Objective function: $C = 3x + 6y$



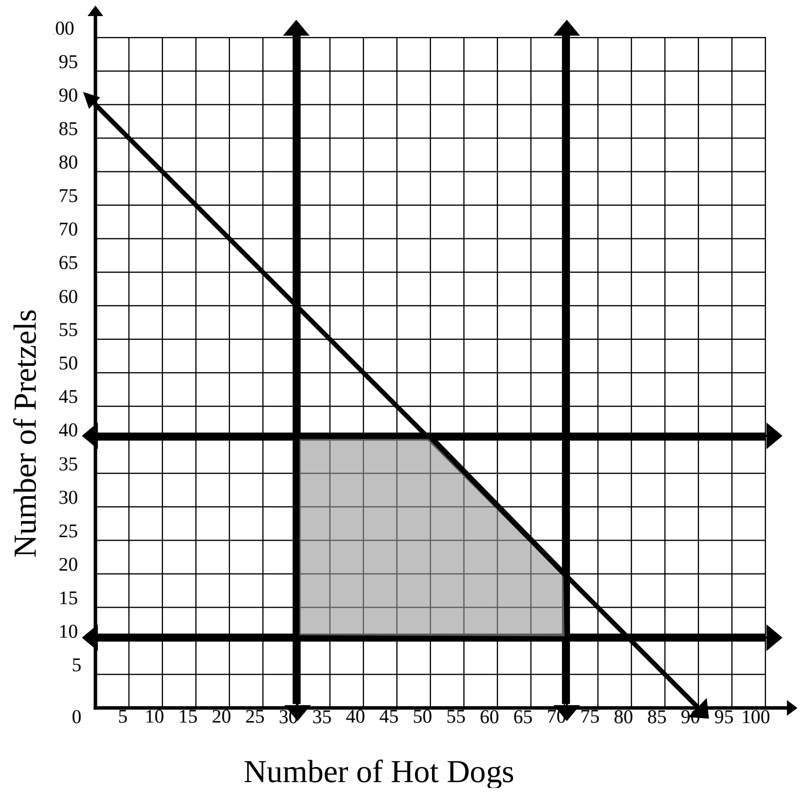
1.3E *Solving Linear Programming Problems*

4) In **section 1.3B** we looked at the selling patterns of a local street vendor sells hotdogs and pretzels. To make a profit, the street vendor must sell at least 30 hotdogs but cannot prepare more than 70. The street vendor must also sell at least 10 pretzels but cannot prepare more than 40. The street vendor cannot prepare more than a total of 90 hotdogs and pretzels altogether.

a) Find the vertices of the feasible region and label them on the graph.

b) The profit is $0.48 on a hotdog and $0.25 on a pretzel. Write an objective function.

c) What combination of hotdogs and pretzels would maximize her profits?



d) She realized that pretzels were better sellers than hotdogs and wanted to increase her profits. She changed the profit of a hotdog to $0.25 and the profit of a pretzel is now $0.48. Write the revised objective function. What combination of hot dogs and pretzel sales gives the best profit now? Show the calculations and write a summary statement.

e) She decided that it would be easier if the sale of every product created a profit of $0.40. Write an objective function for this situation. What combination gives the best profit now? Show the calculations and write a summary statement.

f) Taking into consideration all factors, what profit scenario would you recommend that the street vendor function with?

1.3E *Solving Linear Programming Problems*

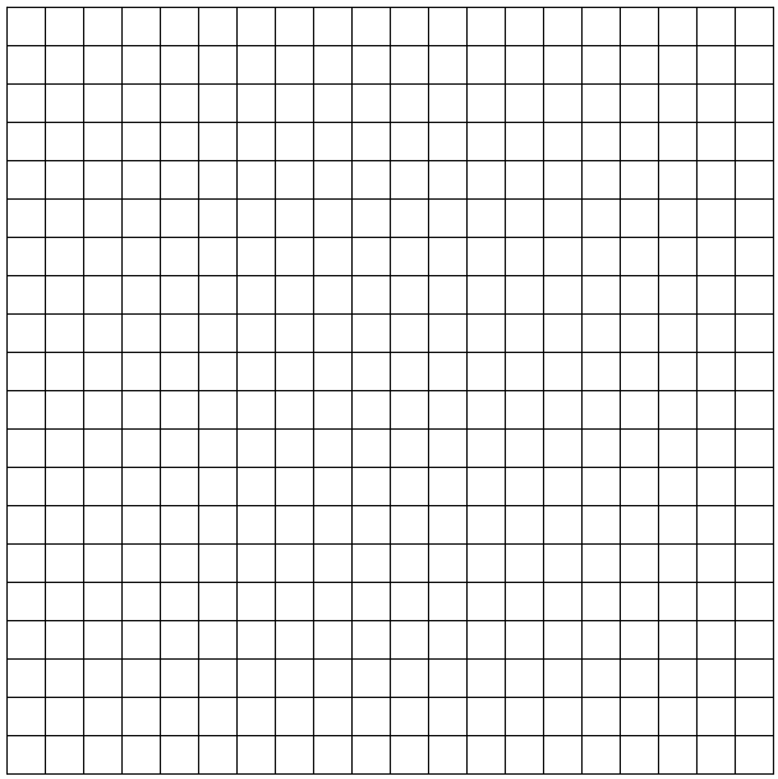
5) Use Linear Programming to solve the problem.

A bakery is making whole-wheat bread and apple bran muffins. For each batch of bread they make $35 profit. For each batch of muffins they make $10 profit. The bread takes 4 hours to prepare and 1 hour to bake. The muffins take 2 hours to prepare and 2 hours to bake. The maximum preparation time available is 16 hours. The maximum baking time available is 10 hours. How many batches of bread and muffins should be made to maximize profits?

a) Define the variables x =__________________________ y = ____________________________________

b) Write the constraints as a system of inequalities. (Hint: There are 4 restrictions)

c) Graph the system of inequalities.



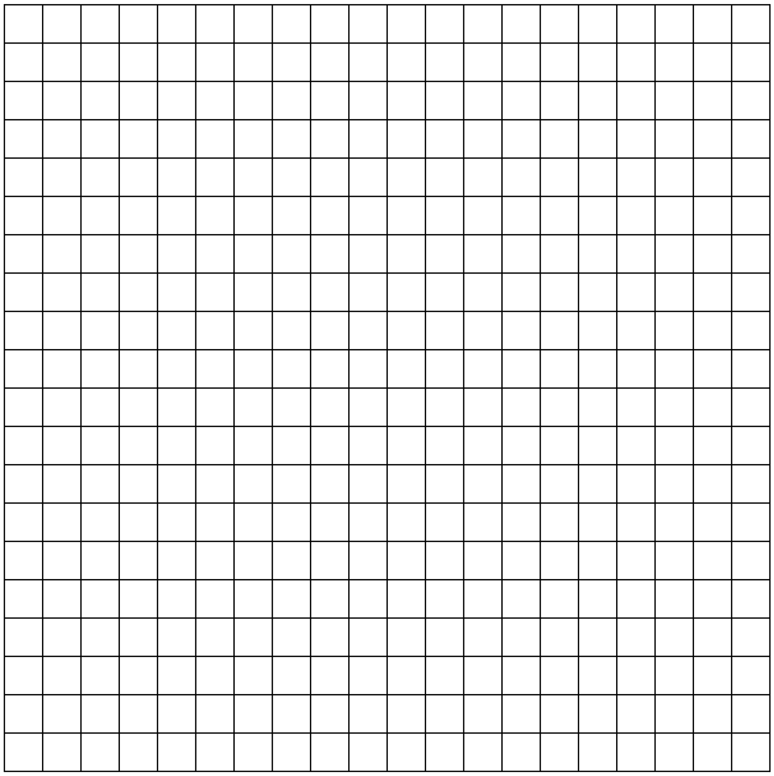
d) What are the vertices of the feasible region?

e) What is the profit for each of these combinations?

f) Summarize your findings to answer the question presented.

6) Larry is starting a yard care business this summer featuring lawn mowing Services or $25 per lawn and yard cleanup (trimming/raking) services for $40 per yard. He is on the summer baseball team so he can only work 24 hours a week. It takes him 1½ hours to mow a lawn and 3 hours to trim and rake a yard. Larry is borrowing the equipment from his uncle who is charging him $2 every time he uses the lawnmower and $1 every time he uses the weed wacker for trimming. He doesn't want to spend more than $20 each week on equipment.

Larry wants to make as much money as possible on his new business. He has talked to his neighbors and is pretty confident that he will have plenty of customers. What combination of mowing lawns and yard trimming will give him the most profit?



1.3E *Solving Linear Programming Problems*

7) The manager of a travel agency is printing brochures and fliers to advertise special discounts on vacation spots during the winter months. Each brochure costs \$0.08 to print, and each flier costs \$0.04 to print. A brochure requires 3 pages, and a flier requires 2 pages. The manager does not want to use more than 600 pages, and she needs at least 50 brochures and 150 fliers. How many of each should she print to minimize the cost?

Section 1.3E

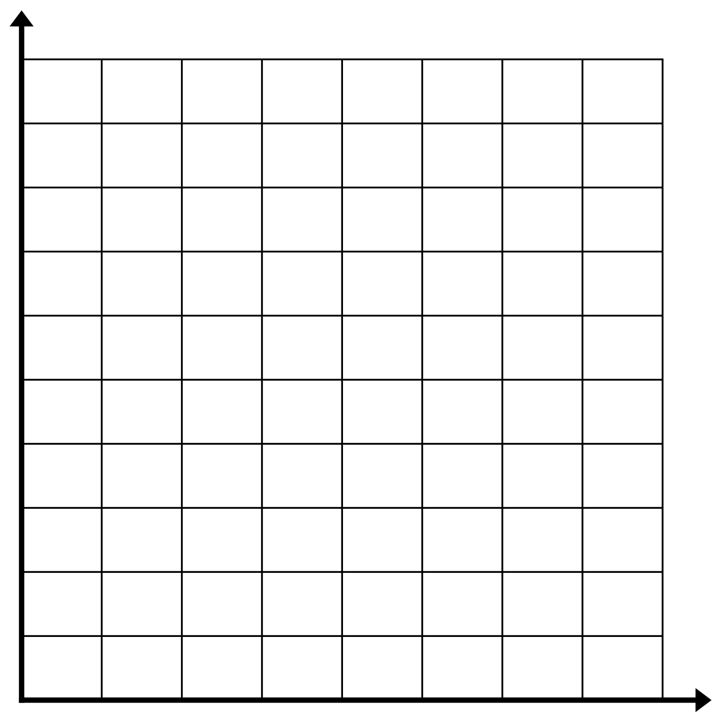
1.3F *Using Graphing Technology for Linear Programming*

#1 – 4: Use your graphing calculator to help you solve the following linear programming problems.

1) The Plexus Dance Theatre Company will appear at the University of Georgia. According to school policy, no more than 2000 general admission tickets can be sold and no more than 4000 student tickets can be sold. It costs \$0.50 per ticket to advertise the dance company to the students and \$1 per ticket to advertise to the general public. The dance company has an advertising budget of \$3000 for this show.

Constraints:

Copy the graph from your calculator and label the vertices:



Find the maximum profit the company can make if it charges \$4 for a student ticket and \$7 for a general admission ticket.

Write a summary statement and identify the number of student tickets should they sell.

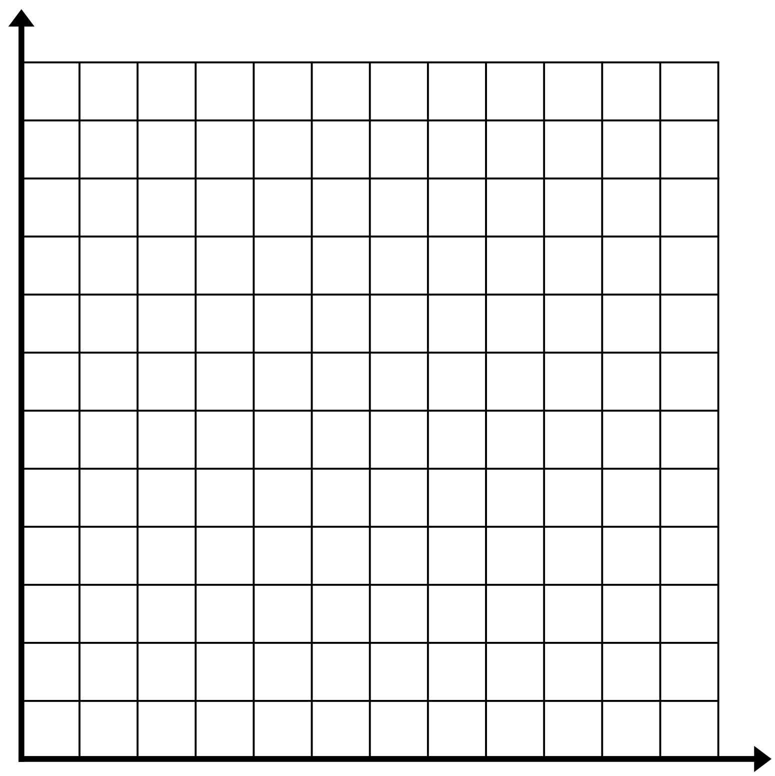
1.3F *Using Graphing Technology for Linear Programming*

#1 – 4 (continued): Use your graphing calculator to help you solve the following linear programming problems.

2) Funtime Airways flies from Palau to Nauru weekly if at least 12 first class tickets and at least 16 tourist class tickets are sold. The plane cannot carry more than 50 passengers. Funtime Airways makes $26 profit for each tourist class seat sold and $24 profit for each first class seat sold

Constraints:

Copy the graph from your calculator and label the vertices:



In order for Funtime Airways to maximize its profits, how many of each type of seat should they sell?

Write a summary statement identifying the maximum profit and the number of each type of seat they need to sell to obtain that profit amount.

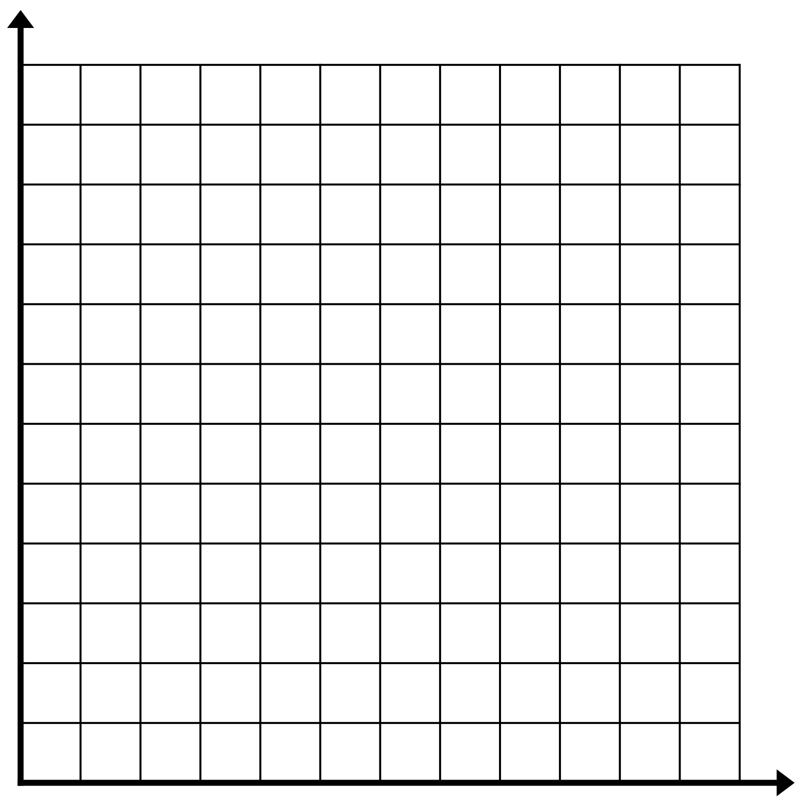
1.3F *Using Graphing Technology for Linear Programming*

#1 – 4 (continued): Use your graphing calculator to help you solve the following linear programming problems.

3) Marcus is creating a low-fat pie crust recipe for his pie shop. Butter has six grams of saturated fat and one gram of polyunsaturated fat per tablespoon. Vegetable shortening has one gram of saturated fat and four grams of polyunsaturated fat per tablespoon. In the recipe, the butter and vegetable shortening will not be more than 25 tablespoons. The butter and vegetable shortening combine for at least 34 grams of saturated fat and at least 44 grams of polyunsaturated fat. Minimize the number of calories in the recipe if butter has 100 calories per tablespoon and vegetable shortening has 115 calories per tablespoon.

Constraints:

Copy the graph from your calculator and label the vertices:



Record the calculations used to determine the minimum number of calories.

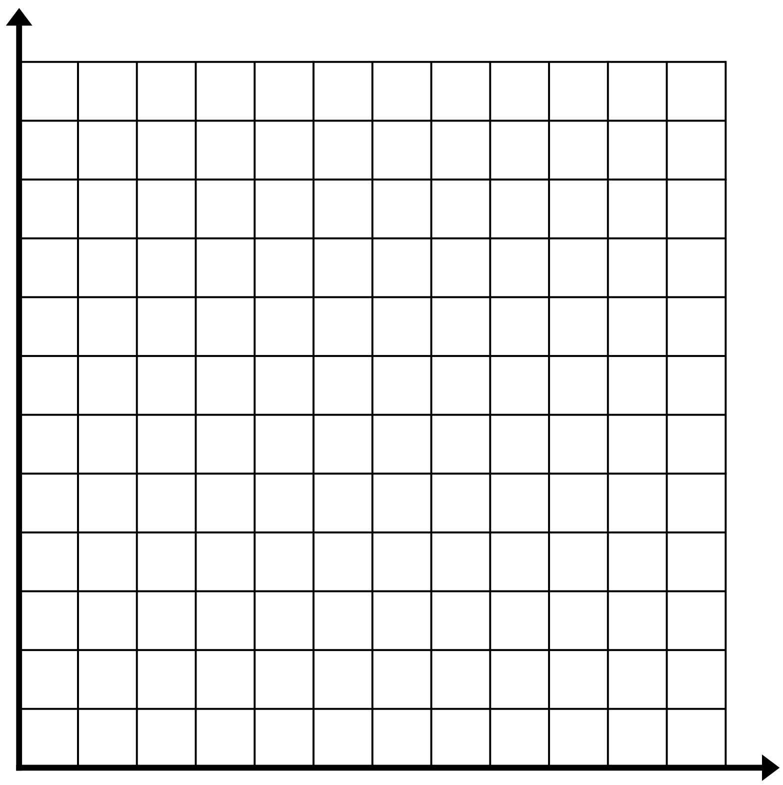
Write a summary statement identifying the minimum number of calories in the recipe and the number of tablespoons of butter and vegetable shortening Marcus should use.

#1 – 4 (continued): Use your graphing calculator to help you solve the following linear programming problems.

4) Reynaldo Electronica manufactures radios and cd players. The manufacturing plant has the capacity to manufacture at most 600 radios and 500 cd players. It costs the company $10 to make a radio and $12 to make a cd player. The company can spend $8400 to make these products. Reynaldo Electronica makes a profit of $19 on each radio and $12 on each cd player.

Constraints:

Copy the graph from your calculator and label the vertices:



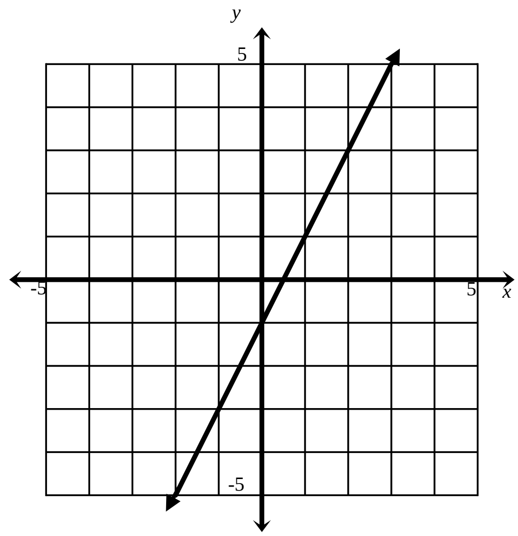
Record the calculations used to determine the maximum the profit.

Write a summary statement identifying the maximum profit and the product they should produce.

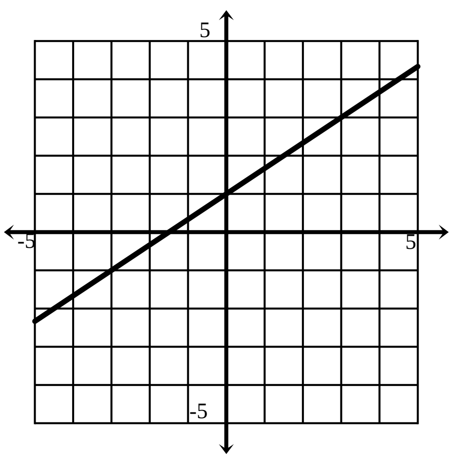
Section 1.3F

Learning Target 1.1: I can demonstrate understanding of how to represent a region on a graph with an inequality.

1) Antonio believes (0, –1) is a solution to the inequality below. Mark believes it is not. Determine which student is correct. Support your answer graphically and algebraically.



2) For each inequality graphed, determine the correct inequality symbol to correctly represent the graph. Show how you determined which inequality symbol to use.

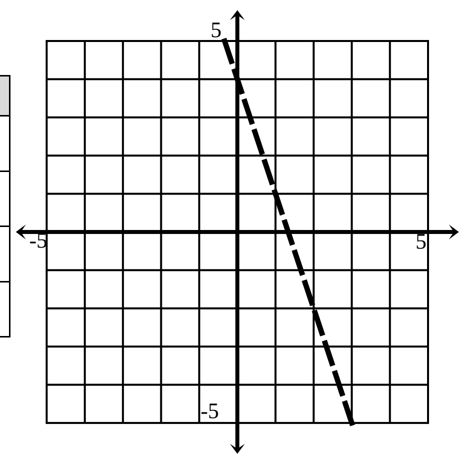


Points on the boundary line

x	***y***

Points on the boundary line

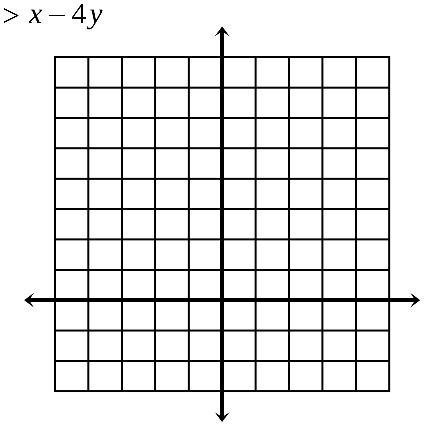
x	***y***



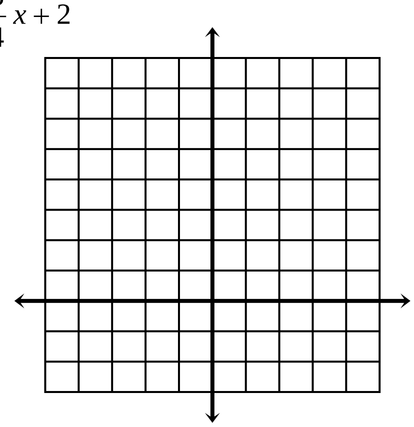
2a) $y \;\square\; \frac{2}{3}x+1$

2b) $3x + y \;\square\; 4$

3) **a)** Graph $8 > x - 4y$

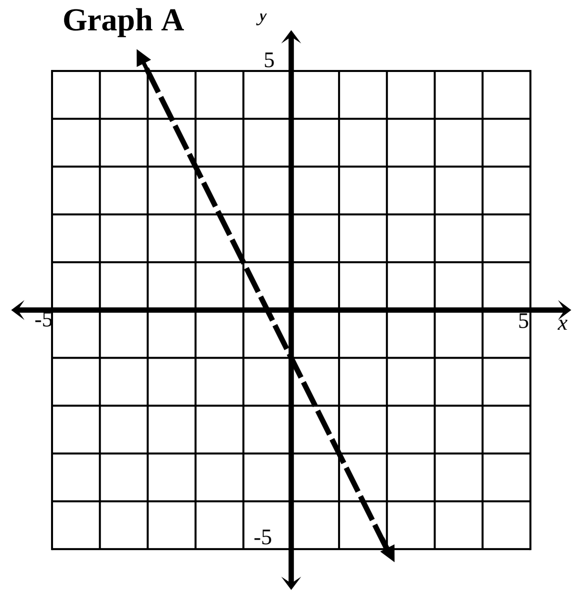


b) Graph $y \le -\frac{3}{4}x+2$



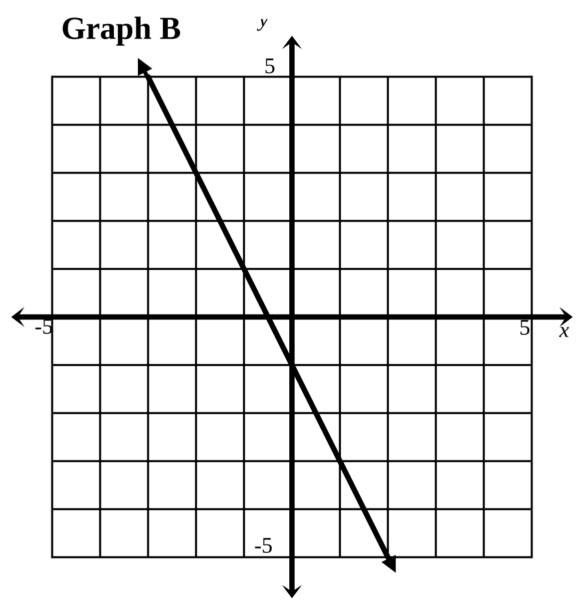
4) Explain where to find the solutions on a graph for each inequality graphed.

a) Graph A:



b) Graph B:

5) Write the inequality for Graph A.



6) Write the inequality for Graph B.

7) Prove algebraically that (5, 6) is a solution to the inequality for Graph A.

8) Prove algebraically that (4, 2) is not a solution to the inequality for Graph B.

Learning Target 1.2: I can demonstrate understanding of real-world situations that can be modeled as linear equations or linear inequalities.

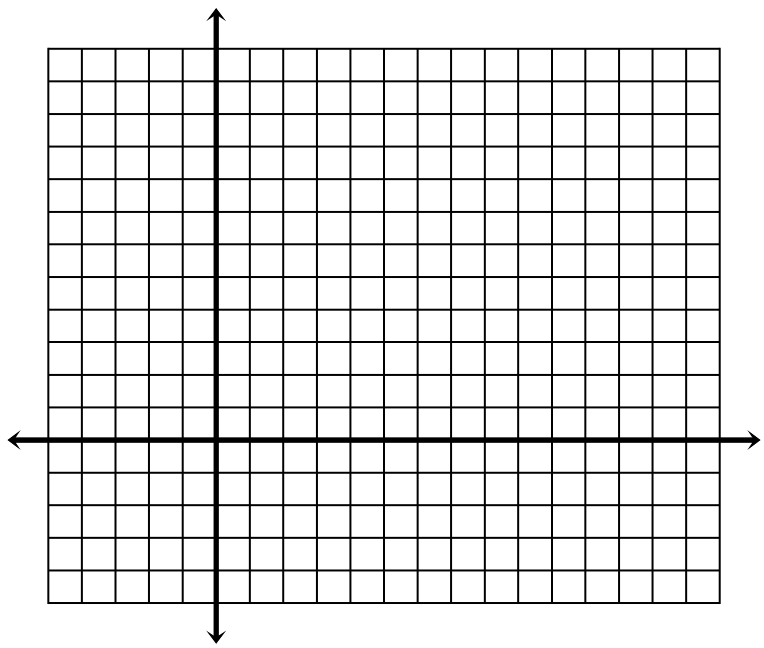
9) Raymond must sell $500 in magazines and newspaper subscriptions in order to meet his fundraiser goal. A magazine costs $15.00 and a newspaper subscription costs $22.00.

a) Define the variables you will use. x : ______________________________

y : ______________________________

b) Write an inequality to describe the fundraising situation for Raymond to meet his goal.

c) Graph the inequality.



d) Identify one solution. Explain what your solution means in the context of this real-world situation.

e) Identify one non-solution. Explain what your non-solution means in the context of this real-world situation.

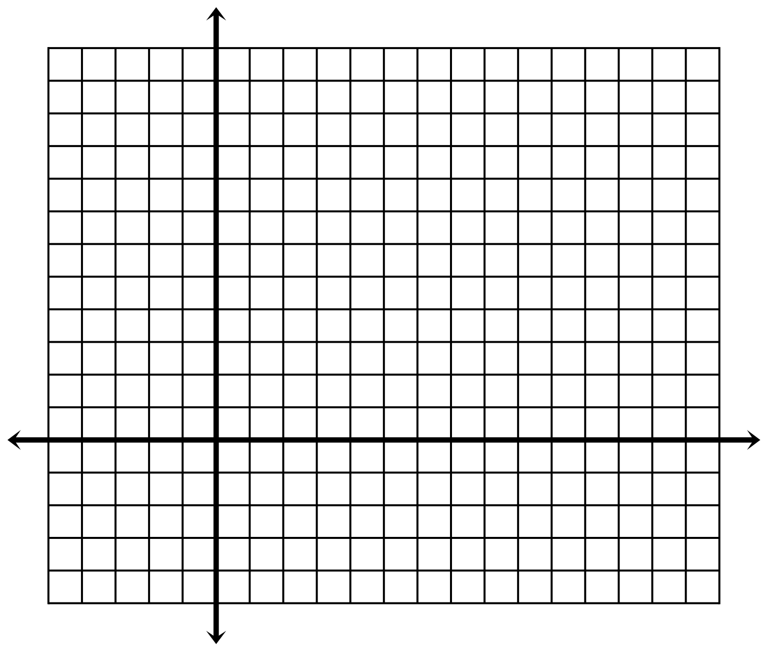
10) During our basketball game, teams score points by shooting baskets (2 points) or by making free throws (1 point). We do not make any 3-point shots. The opposing team scores 44 points.

a) Define the variables you will use. x : ________________________________

y : ________________________________

b) Write an inequality to describe how many regular baskets and how many free throws our team must make to win the game.

c) Graph the inequality.



d) Is (15, 4) a solution? Explain in terms of the context of the problem.

Unit 1 *Review Material*

Learning Target 1.3: I can represent real-world situations as a linear programming problem and demonstrate an understanding of how to find reasonable solutions.

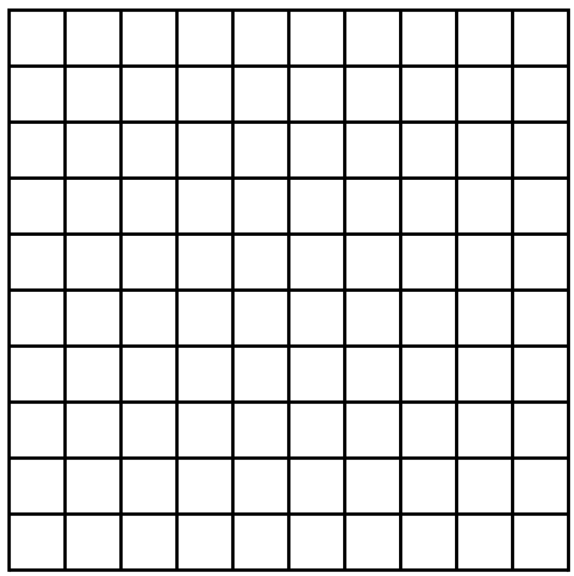
11) A plant makes aluminum and copper wire. Each point of aluminum wire requires 5 kilowatt hours (kwh) of electricity and 1/4 hour of labor. Each pound of copper wire requires 6 kwh of electricity and 1/5 hour of labor. Electricity is limited to 450 kwh per day and labor to 20 hours per day. If the profit from aluminum wire is \$0.25 per pound and the profit from copper is \$0.40 per pound, how much of each should be produced to maximize profit and what is the maximum profit?

a) Define the variables you will use and label the axes of the graph.

x : ____

y : ____

b) Organize the information and write the constraints.



c) Write the objective function.

d) Graph the constraints and write their inequality near each boundary line.

e) Name the vertices and write each on the graph.

f) What is the maximum profit? What is the minimum profit?

g) Write a summary statement answering the question that was presented.

12) A farmer wants to customize the fertilizer he uses for his current crop. He can buy plant food mix A and plant food mix B. Each cubic yard of food A contains 20 pounds of phosphoric acid, 30 pounds of nitrogen and 5 pounds of potash. Each cubic yard of food B contains 10 pounds of phosphoric acid, 30 pounds of nitrogen and 10 pounds of potash. He requires a minimum of 460 pounds of phosphoric acid, 960 pounds of nitrogen and 220 pounds of potash. If food A costs \$30 per cubic yard and food B costs \$35 per cubic yard, how many cubic yards of each food should the farmer blend to meet the minimum chemical requirements at a minimal cost? What is this cost?

Unit 1 Review