Math 1

Linear Programming (Day 4)

SWBAT write and graph linear inequalities to model real-life situations to maximize an objective function.

Objective Function: ____

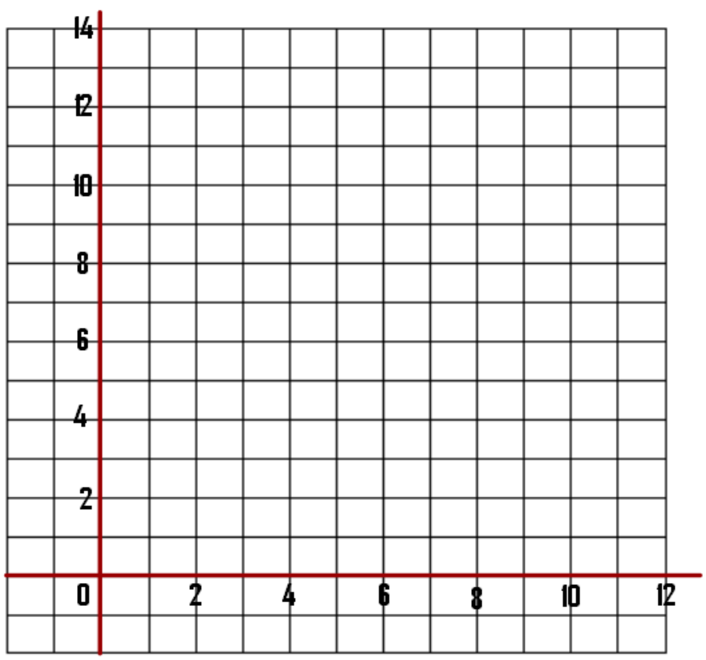
Steps to Solving a Linear Programming System of Inequalities

Step 1: Define your variables
Step 2: Organize your information
Step 3: Write the inequalities
Step 4: Set up the objective function (maximize or minimize)
Step 5: Graph inequalities
Step 6: Find the vertices
Step 7: Plug vertices back into objective function
Step 8: Answer the question

Example 1: A farmer can plant up to 8 acres of land with wheat and barley. He can earn $5,000 for every acre he plants with wheat and $3,000 for every acre he plants with barley. His use of a necessary pesticide is limited by federal regulations to 10 gallons for his entire 8 acres. Wheat requires 2 gallons of pesticide for every acre planted and barley requires just 1 gallon.

What is the maximum profit he can make?

Write two inequalities. Then, find the intersection of these inequalities to show all combinations of acres of wheat and barley that the farmer can make with the given constraints so that he gets the maximum profit.



Let x = the number of acres of wheat

y = the number of acres of barley

Objective function: What is the maximum profit the farmer can make

p= total profit that can be earned.

Objective function equation: ____________________

Constraints:

Inequality #1: ________________________________

Inequality #2: ________________________________

Inequality #3: ________________________________

Inequality #4: ________________________________

Objective Function: ____

Vertex 1: ______________ = ____ = ______________

Vertex 2: ______________ = ____ = ______________

Vertex 3: ______________ = ____ = ______________

Vertex 4: ______________ = ____ = ______________

Solution: ____

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Example 2: A painter has exactly 32 units of yellow dye and 54 units of green dye. He plans to mix as many gallons as possible of color A and color B. Each gallon of color A requires 4 unites of yellow dye and 1 unit of green dye. Each gallon of color B requires 1 unit of yellow dye and 6 units of green dye.

What is the maximum number of gallons he can mix.

Let x = ______________________________

y = ______________________________

Objective function: What is the maximum number of gallons he can mix.

g= ______________________________

Objective function equation: ______________

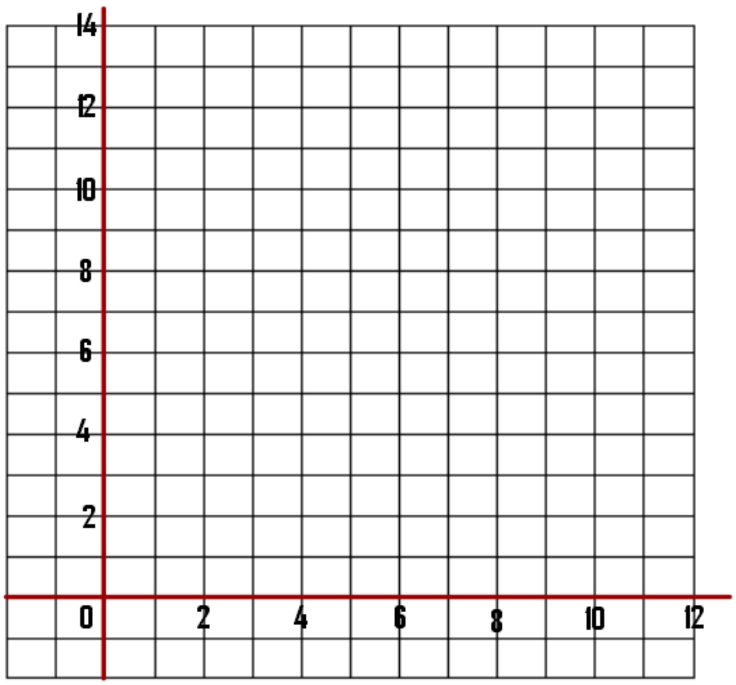
Constraints:

Inequality #1: ________________________

Inequality #2: ________________________

Inequality #3: ________________________

Inequality #4: ________________________



Objective Function: ______________________________

Vertex 1: __________ = ______________________________ = __________

Vertex 2: __________ = ______________________________ = __________

Vertex 3: __________ = ______________________________ = __________

Vertex 4: __________ = ______________________________ = __________

Solution: ____

Steps to Solving a Linear Programming System of Inequalities

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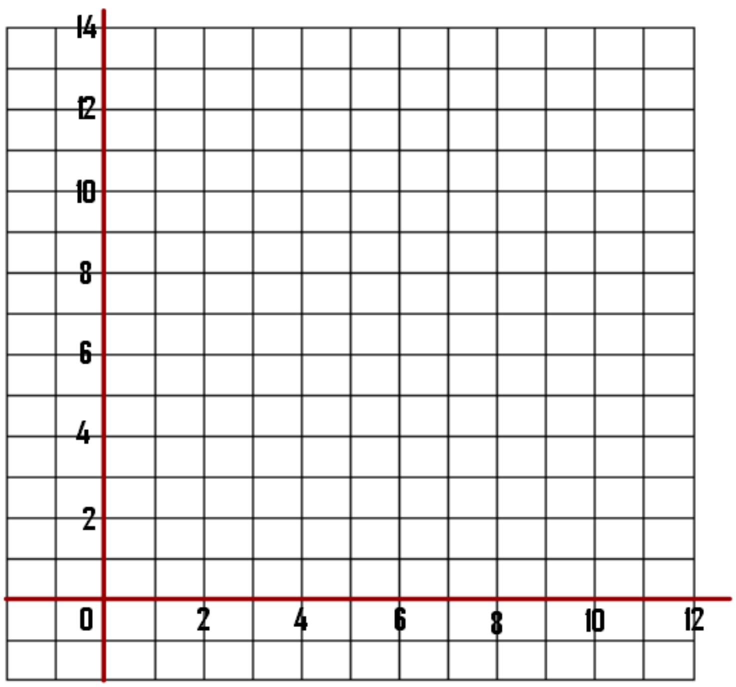
Example 3: The bead store sells material for customers to make their own jewelry. Customers can select beads from various bins. Grace wants to design her own Halloween necklace from orange and black bead. She wants to make a necklace that is at least 12 inches long, but no more than 24 inches long. Grace also wants her necklace to contain black beads that are at least twice the length of orange beads. Finally, she wants her necklace to have at least 5 inches of black beads.



Let x = ____

y = ____

Objective function: What is the maximum number of gallons he can mix.

g= ____

Objective function equation: ____________________

Constraints:

Inequality #1: ______________________________

Inequality #2: ______________________________

Inequality #3: ______________________________

Inequality #4: ______________________________

Inequality #5: ______________________________

Inequality #6: ______________________________

Objective Function: ____

Vertex 1: ______________ = ____ = ______________

Vertex 2: ______________ = ____ = ______________

Vertex 3: ______________ = ____ = ______________

Vertex 4: ______________ = ____ = ______________

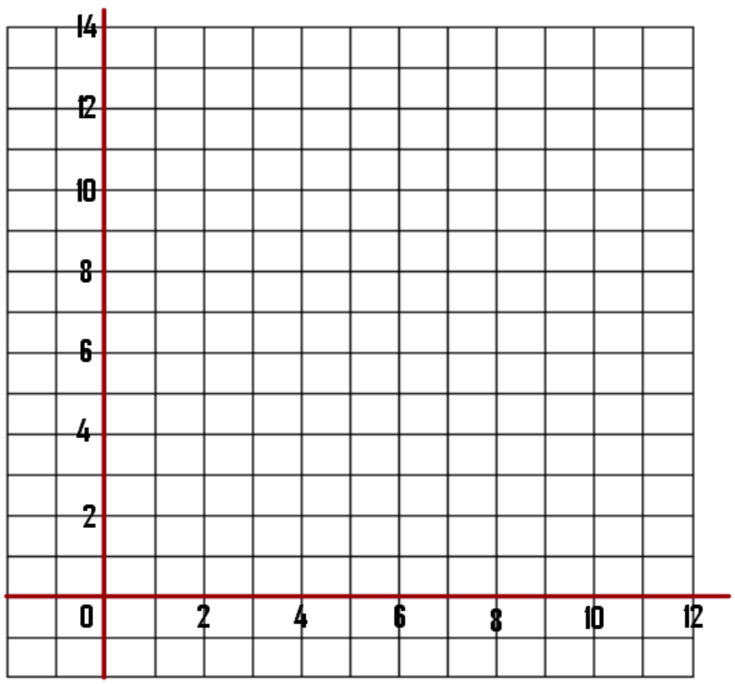
Solution: ____

Example 4: Susan is baking cakes and pies for a fundraiser. Susan is confident that she will be able to sell all the cakes and pies that she makes. There are *two constraints* that limit her production today:

SUGAR: Each cake requires 5 cups of flour. Each pie requires 3 cups of flour. Susan has 30 cups of flour total.

EGGS: Each cake requires 2 eggs. Each pie requires 3 eggs. Susan has 24 eggs total.

Write two inequalities. Then, find the intersection of these inequalities to show all combinations of cakes and pies that Susan can make with the two constrains given.



Let x = ______________________________

y = ______________________________

Objective function: ______________________

p= ______________________________

Objective function equation: ______________

Constraints:

Inequality #1: ______________________

Inequality #2: ______________________

Inequality #3: ______________________

Inequality #4: ______________________

Suppose each cake makes a profit of \$3.50 and each pie makes a profit of \$4. How many cakes and pies should Susan make in order to maximize her profit?

Objective Function: ______________________________

Vertex 1: __________ = ______________________________ = __________

Vertex 2: __________ = ______________________________ = __________

Vertex 3: __________ = ______________________________ = __________

Vertex 4: __________ = ______________________________ = __________

Solution: ____

The Box Bakery

Jack and Jill Box own a small bakery that makes fresh cookies daily. They bake two kinds of cookies – plain cookies and cookies with icing. The cookies are sold by the box, and Jack and Jill are confident they can sell all the cookies they make. However, there are three constraints that limit their production today:

DOUGH: One box of plain cookies requires 1.2 pounds of cookie dough.
One box of iced cookies requires 0.9 pounds of cookie dough.
Jack and Jill have 72 pounds of cookie dough.

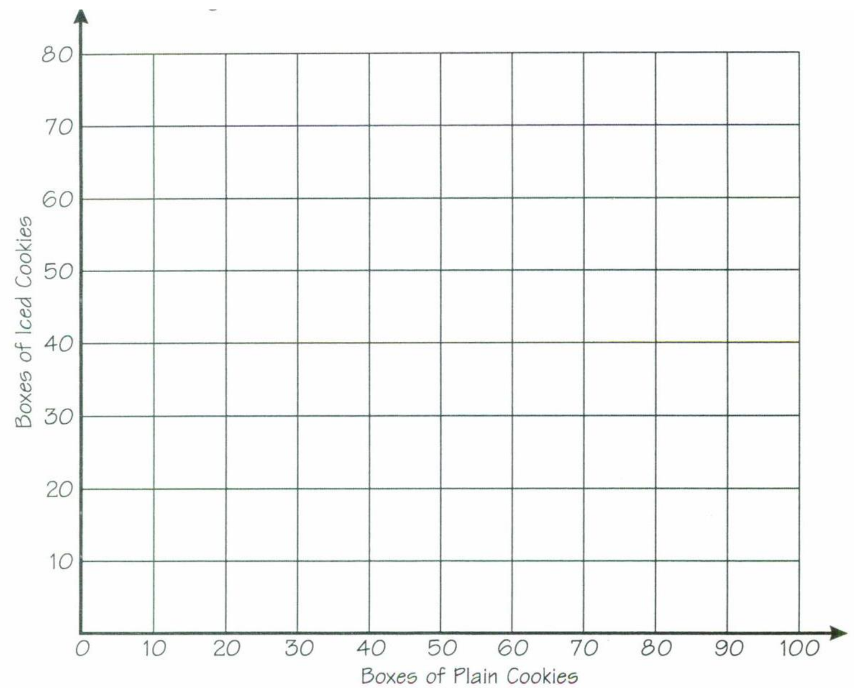
ICING: Plain cookies require no icing.
One box of iced cookies requires 0.4 pounds of icing.
Jack and Jill have 20 pounds of icing.

TIME: One box of plain cookies requires about 0.1 hour to prepare.
One box of iced cookies requires about 0.15 hour to prepare.
Jack and Jill together have 9 hours for preparation.

Write three inequalities. Then, find the intersection of these inequalities to show all combinations of cookies that Jack and Jill can make with the constraints given.

Let x = ____

y = ____



Inequality #1: ________________________________

X-intercept: _______ Y-intercept: _______

Inequality #2: ________________________________

X-intercept: _______ Y-intercept: _______

Inequality #3: ________________________________

X-intercept: _______ Y-intercept: _______

Suppose the profit on each box of plain cookies is \$2.00 and the profit on each box of iced cookies is \$3.00. How many boxes of each kind of cookie should jack and Jill make to maximize profit?

Objective Function: ____

Vertex 1: __________ = ____ = _______________

Vertex 2: __________ = ____ = _______________

Vertex 3: __________ = ____ = _______________

Vertex 4: __________ = ____ = _______________

Solution: ____