Linear Programming Problem number 1
(Keep all these so you have a finished portfolio)

Picturing pictures:

Joe is an artist who specializes in geometric designs. He is trying to get ready for a street fair next month.

Joe paints both watercolors and pastels. Each type of picture takes him about the same amount of time to paint. He figures he has time to do a total of **AT MOST** 16 pictures.

The <u>materials for each pastel will cost him $5</u>, and the materials <u>for each watercolor will cost him $15.</u> He has $180 to spend on materials. He makes a profit of $40 on each pastel and a profit of $100 on each watercolor.

1) Choose variables to represent the amount of each pastel and watercolor that he makes.
2) Use your organizational chart to write a system of inequalities.
3) Make the graph to show the feasible region that satisfy the constraints.
4) Test 5 different sets of points into your profit equation(40p+100w) and see if you can find one that produces the most profit.

2) Suppose he thought that $1,000 would be a great profit. Find three different combinations of points from your feasible region that would produce $1,000.

3) Now suppose he only wanted to make $500 in profit. Find three different combinations of watercolors and pastels that would earn a profit of $500.

What do you think he should make if he wants to make the most profit?

He has a feeling that there will be a big demand for his work. He decides to change his profit to $50 on a pastel and $175 on a watercolor. Find some combinations of points that give a profit of $700

What is the most money that he can make_____

Advanced Algebra Unit 6: Advanced Systems of Equations

Linear Programming Problems The Ticket problem and the Ski Problem

<u>Directions: Write your constraints for each problem, graph the feasible region, write the "profit" equation, test your corner points to find the combination that maximizes profit.</u>

2) A ticket office sells General Admission tickets and reserved tickets. The auditorium holds no more than 5000 people. There can be no more than 3000 reserved tickets and no more than 4000 general admission tickets sold. General Admission tickets sell for $75. Reserved tickets sell for $125. How many of each type of ticket should the auditorium sell to maximize their profit?

3) A ski manufacturer makes two types of skis. They have a fabricating department and a finishing department. A pair of downhill skis require 6 hours to fabricate and 1 hour to finish. A pair of cross county skis require 4 hours to fabricate and 1 hour to finish. The fabricating department has 108 hours of labor available per day. The finishing department has 24 hours per day. The profit on each pair of downhill skis is $40 and $35 for cross country. **How many pairs of skis should the company produce to maximize their profit?**

The Tourist Problem

A tourist agency can sell up to 1200 travel packages for the Super Bowl. The packages they can sell include airfare, weekend accommodations, and a choice of 2 types of flights. A non- stop flight and a two stop flight. Each non- stop flight can carry up to 150 people and each two stop flight can carry up to 100 people. The travel agency can locate no more than 10 planes for the travel package. Packages of the non-stop flight sell for $1200. Packages for the two stop flight sell for $900. Assume each plane will carry the maximum amount of people. What should they sell to make the maximum amount of revenue?

#5: The Door Problem

A company has two plants that produce windows and doors. They can make a profit of $5 on each window and a profit of $3 on each door. In plant A, each window requires 3 hours and each door requires 2 hours. Plant A has 18 hours available for manufacturing. In plant B each window requires 1.5 hours and each door requires .75 hours. Plant B has 7.5 hours available for assembly. How many of each should they produce to make the most profit?

Algebra Problem #6

Martha is taking Algebra and History. Let a represent the number of algebra assignments she completes in a week. Let h represent the number of history assignments she completes in a week. She plans to complete at least 2 Algebra assignments this week. She plans to complete less than 4 History assignments this week. Each Algebra assignment takes 1.5 hours to complete and each History assignment takes 1.25 hours to complete. She can spend no more than 15 hours this week working on assignments for these two classes.

1) Write the constraints for this problem

2) Graph the constraints to find the feasible region

Best Buy Problem #7

Apple is sending a shipment of computers to Best Buy. Let d represent the number of desktop computers shipped, and let l represent the number of laptop computers shipped. Best Buy has requested that no more than 30 desktop computers are included with the shipment and they have requested that there be at least 2 times as many laptops as desktops on the shipment. The weight of a laptop computer is 2.5 pounds. The weight of a desktop is 10 pounds. The weight of the shipment cannot exceed 460 pounds.

1) Write the constraints for this problem

2) Graph the constraints to find the feasible region.

Practicing the feasible Region #8

3) Graph the following systems of inequalities on the axis below and find the feasible region.

$$\begin{cases} 2y + 4x < 40 \\ 3x + 9y > 27 \\ x \leq 8 \\ x \geq 2 \end{cases}$$

Linear Programming #9 Rock and Rap:

The Hits on Shoestring music company is planning its next month's work. The company makes CD's of both rock and rap music.

It costs the company an average of $15,000 to produce a rock CD and an average of $12,000 to produce a rap CD. The higher cost for the rock CD's comes from needing more instrumentalists for rock CD's. Also it takes about 18 hours to produce a rock CD and about 25 hours to produce a rap CD.

The company can afford to spend up to $150,000 on production next month. Also, according to its agreement with the employee union, the company will spend at least 175 hours on production.

Hits on a Shoestring earns $20,000 in profit on each rock CD it produces and $30,000 in profit on each rap CD it produces. But the company recently promised its distributor that it would **not release more rap music than rock music,** because the distributor thinks that the company is more closely associated with rock in the public mind.

The company needs to decide how many of each type of CD to make. Note: The company can make a fraction of a CD and finish it the month after.

1) Make your organizational chart

2) Find your constraints

3) Graph the feasible region

4) Test all the corner points to find the combination of CD's that gives the company the most profit. Show that work. Remember the profit is 20,000 on rock and 30,000 on rap.

ROCK and RAP Variation

Rock and Rap Variation

In Rock and Rap you figured out how many rock CD's and how many rap CD's Hits on Shoestring should produce to maximize its profit.

Suppose the conditions were the same as in that problem except that the profits were reversed. In other words, suppose the company made $30,000 profit on each rock CD and $20,000 profit on each rap CD.

Would this change your advice to the company about how many CD's of each type to produce to maximize its profit? If so, how many of each type should the company make, and what would be the profit?

Below is the original problem. You should be able to use your same corner points because the constraints of the problem have not changed.

Linear Programming Problem #11- Cookies:

Abby and Bing Woo own a small bakery that specializes in cookies. They make only two kinds of cookies- plain and iced. They need to decide how many dozens of each kind of cookie to make for tomorrow.

The Woo's know each dozen of their plain cookies requires 1 pound of cookie dough (and no icing), and each dozen of their iced cookies requires .7 pounds of cookie dough and .4 pounds of icing. The Woo's also know that each dozen of the plain cookies requires about .1 hours of preparation time, and each dozen of the iced cookies requires about .15 hours of preparation time. Finally, they know that no matter how many of each kind they make, they will be able to sell them all.

The Woo's decision is limited by three factors.

- The ingredients they have on hand- they have 110 pounds of cookie dough and 32 pounds of icing.
- The amount of oven space available-they have room to make a total of 140 dozen cookies for tomorrow.
- The amount of preparation time available-together they have 15 hours for cookie preparation.

They would like to make as much money as possible. The plain cookies sell for $6.00 a dozen and cost $4.50 to make. The iced cookies sell for $7.00 a dozen and cost $5.00 to make.

You need to make your feasible region so that you can answer the following question:

How many dozens of each kind of cookie should Abby and Bing make so that their profit is as much as possible?