Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ period \_\_\_\_\_\_\_\_\_\_\_\_

**Algebra 2: LESSON 14 ~ Applications of Linear Programming (3.6)**

**Steps:** 0. *Read the whole problem!*

1. Define the variables. What is your x and y?
2. Write the constraints (inequalities). Is there a limit we can’t go beyond for x or for y?
3. Write the objective function. (This is your $f(x,y) =$ equation)
4. Graph the constraints and shade the feasible region.
5. Find the vertices of the feasible region AND evaluate $f\left(x,y\right) $for each vertex.
6. Answer the question.

**REVIEW:**

Graph the system of inequalities. Name the coordinates of the vertices of the feasible region. Find the maximum and minimum values of the given function for the region.



 $x-3y\leq 0$

 $x-3y\geq -15$

 $4x+3y\geq 15$

 $x\leq 6$

 $F\left(x,y\right)=5x+2y$

|  |  |  |
| --- | --- | --- |
| (x, y) | 5x+2y | F(x, y) |
|  |  |  |

**Example 1:**

Rosalyn works no more than 20 hours a week during the school year. She is paid $10 an hour for tutoring Geometry students, and $7 an hour for delivering pizzas for Pizza King. She wants to spend at least 3 hours but no more than 8 hours a week tutoring. Find Rosalyn’s maximum earnings.

**1st-** Define the variables. *x* = number of hours tutoring *y* = number of hours delivering pizza



**2nd -** Set up the constraints (inequalities):

 FOR TOTAL HOURS WORKED:

 FOR HOURS TUTORING:

 FOR HOURS DELIVERING PIZZA:

**3rd –** Write an equation for her weekly profit:

 $f\left(x,y\right)=$ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**4th -**  Graph the constraints and shade the feasible region.

**5th -** Find the vertices of the feasible region, and find the Maximums and Minimums of Rosalyn’s weekly earnings.

|  |  |  |
| --- | --- | --- |
| (x, y) | 5x+2y | F(x, y) |
|  |  |  |

**6th -** Answer the question. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Example 2:**

The Northern Wisconsin Paper Mill can make 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 newsprint are required daily by regular customers. If the profit on a unit of notebook paper is $500 and the profit on a unit of newsprint is $350, how many units of each paper should the manager have the mill produce each day for maximize profits?

**1st ~** Define the variables. *x* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 *y* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2nd ~** Set up theconstraints:

 For total amount of paper:

 For units of notebook paper:

 For units of newsprint:

**3rd ~**  Write the equation for the Mill’s daily profit.



**4th ~** Graph all the constraints and shade the feasible region.

**5th ~** Find the vertices.Evaluate the objective function.

|  |  |  |
| --- | --- | --- |
| (x, y) | F(x, y) =  | F(x, y) |
|  |  |  |

**6th ~** Answer the question. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Example 3:**

As a receptionist for a veterinarian, one of Dolores Alvarez’s tasks is to schedule appointments. She allots 20 minutes for a routine office visit and 40 minutes for a surgery. The veterinarian cannot do more than 6 surgeries a day. The office has 7 hours available for appointments. If an office visit costs $55, and most surgeries cost $125, find a combination of office visits and surgeries that will maximize the income that the veterinarian practice receives per day.

**1st ~** Define the variables. *x* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 *y* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2nd ~** Set up theconstraints:

 Total time for appointments (remember that all units of time should be the same!):

 For office visits:

 For surgeries:

**3rd ~**  Write the equation for the veterinarians daily profit.



**4th ~** Graph all the constraints and shade the feasible region.

**5th ~** Find the vertices.Evaluate the objective function.

|  |  |  |
| --- | --- | --- |
| (x, y) | F(x, y) =  | F(x, y) |
|  |  |  |

**6th ~** Answer the question. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Example 4:**

A local herb shop is producing 2 perfumes: Gentle Rose and Rich Gardenia. The owner, who has equipment that can make up to 3000 oz of perfume, cannot afford to spend more than $9000. Each bottle of Gentle Rose is 2 oz and costs $3 to make with a profit over cost of $4. Each bottle of Rich Gardenia is 1.5 oz and costs $6 with a profit over cost of $5. How many bottles of each perfume should be made for maximum profit, and what is the max profit?

**1st ~** Define the variables. *x* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 *y* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2nd ~** Set up theconstraints:

 For total oz of perfume:

 For oz of Gentle Rose:

 For oz of Rich Gardenia:

**3rd ~**  Write the equation (objective function) for the Herb Shop’s



 profit. (Think about the values you put here – profit per

 bottle is the same as “profit over cost”.)

**4th ~** Graph all the constraints and shade the feasible region.

**5th ~** Find the vertices.Evaluate the objective function.

|  |  |  |
| --- | --- | --- |
| (x, y) | F(x, y) =  | F(x, y) |
|  |  |  |

**6th -**Answer the question. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***NOTE:*** Sometimes finding vertices for linear programming can be a challenge. You can use your graphing calculator to find vertices.

**Using a Graphing Calculator to find Vertices**

**Step 1:** Set up all of your inequalities, solve for y= , then input them into the calculator as equations. You can’t graph functions that are only in terms of x (vertical lines).

**Step 2:** Set the window by figuring out the biggest x-intercept among all of your equations, and the biggest y- intercept among the equations. You should set your XMAX and YMAX values a little past that. Set your XMIN and YMIN a bit below 0. Change your XSCL (x-scale) and YSCL (y-scale) into something you would use to graph by hand.

**Step 3:** Find your intercepts (vertices). 2nd/Trace/5:intersect (arrow left or right until your over the intersection) Hit “Enter” 3 times. This should give you your vertex.

**Step 4:** If you have vertices on vertical lines (x=something), plug that value of x into the equation of the line that’s intersecting it. This will give you a value for y, and that gives you an intersection point of (x, y).