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 equation)
4. Graph the constraints and shade the feasible region.
5. Find the vertices of the feasible region AND evaluate 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, 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:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**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).