HOMEWORK???

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NOTE: Each question requires a graph to get possible solutions!

10. Spence, a disc jockey, is often hired to play weddings.

- His contract states that he will play no longer than 3 h, with no more than 12 songs each hour. $3 \times 12 = 36$ total
- He likes to play two or more songs for young listeners for every one song he plays for older listeners.

Determine three possible combinations of numbers of songs he could play.

y young depends on x

Variables ⇒ $x \rightarrow$ # of songs for older listeners

$y \rightarrow$ # of songs for younger listeners

$x \in W \quad y \in W$

$y \geq 2x$

$x + y \leq 36$

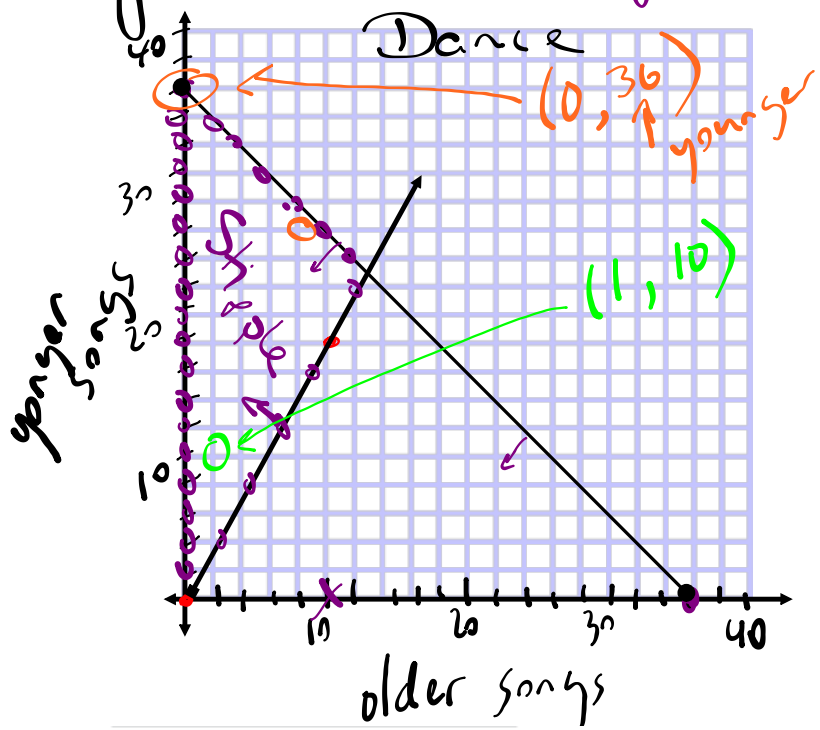
Test (10,0)

LS ?	RS
0	20
NO	

$x + y = 36$

x int (36, 0)

y int (0, 36)



$y = 2x$

x	y
0	0
10	20

10. e.g., 28 songs for young listeners and 4 songs for older listeners; 18 songs for young listeners and 8 songs for older listeners; 24 songs for young listeners and 6 songs for older listeners

Notes - Optimization Problems.pdf

5.4 Optimization Problems I: Creating the Model

Linear Inequality

optimization problem
A problem where a quantity must be maximized or minimized following a set of guidelines or conditions.

constraint
A limiting condition of the optimization problem being modelled, represented by a linear inequality.

objective function
In an optimization problem, the equation that represents the relationship between the two variables in the system of linear inequalities and the quantity to be optimized.

OVERLAP

feasible region
The solution region for a system of linear inequalities that is modelling an optimization problem.

Need to Know

GRAPH

- You can create a model for an optimization problem by following these steps:

Step 1. Identify the quantity that must be optimized. Look for key words, such as *maximize* or *minimize*, *largest* or *smallest*, and *greatest* or *least*.

Step 2. Define the variables that affect the quantity to be optimized. Identify any restrictions on these variables.

Step 3. Write a system of linear inequalities to describe all the constraints of the problem. Graph the system.

Step 4. Write an objective function to represent the relationship between the variables and the quantity to be optimized.

↳ not graphed
↳ is an equation
↳ do some Math

EXAMPLE of an OPTIMIZATION Problem...

Mick and Keith make MP3 covers to sell, using beads and stickers.

- At most, 45 covers with stickers and 55 bead covers can be made per day.
- Mick and Keith can make 45 or more covers, in total, each day.
- It costs $0.75 to make a cover with stickers, $1.00 to make one with beads.

Let x represent the number of covers with stickers and let y represent the number of bead covers.

Let C represent the cost of making the covers.

RESTRICTIONS: $x \in W$ $y \in W$

CONSTRAINTS: $x \leq 45$ $y \leq 55$ $x+y \geq 45$

OBJECTIVE FUNCTION: $C = 0.75x + 1.00y$

a) Graph the solution set.

*not graph

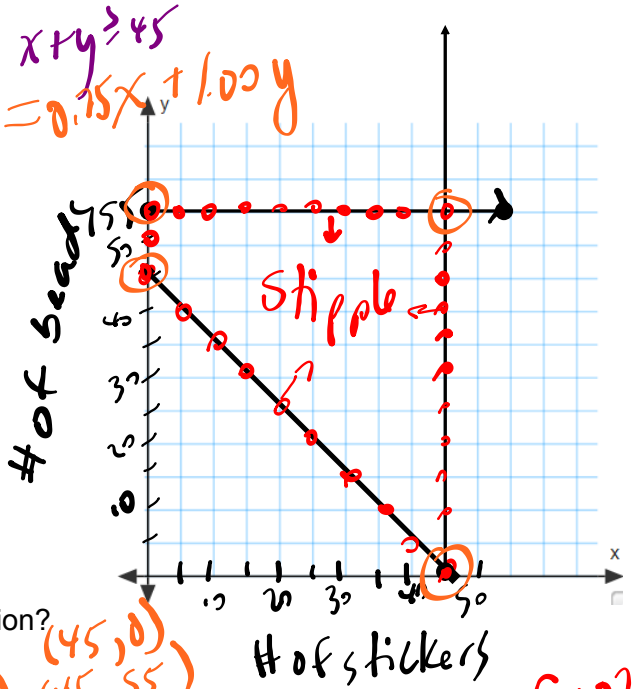
$x+y=45$

x int (45,0)

y int (0,45)

$x=45$

$y=55$



* max/min solutions

b) What are the vertices of the feasible region?

points of intersection

(0,45) (45,0) (0,55) (45,55)

c) Which point would result in the maximum value of the objective function?

(45,55) → $88.75

d) Which point would result in the minimum value of the objective function?

(45,0) → $33.75

vertex	$C = 0.75x + 1.00y$
(0,45)	$45
(0,55)	$55
(45,0)	$0.75(45) = 33.75
(45,55)	$0.75(45) + 1.00(55) = 88.75

In Summary

Key Ideas

- To solve an optimization problem, you need to determine which combination of values of two variables results in a maximum or minimum value of a related quantity.
- When creating a model, the first step is to represent the situation algebraically. An algebraic model includes these parts:
  - a defining statement of the variables used in your model
  - a statement describing the restrictions on the variables
  - a system of linear inequalities that describes the constraints
  - an objective function that shows how the variables are related to the quantity to be optimized
- The second step is to represent the system of linear inequalities graphically.
- In optimization problems, any restrictions on the variables are considered constraints. For example, if you are working with positive real numbers, $x \geq 0$ and $y \geq 0$ are constraints and should be included in the system of linear inequalities.

Need to Know

- You can create a model for an optimization problem by following these steps:

Step 1. Identify the quantity that must be optimized. Look for key words, such as *maximize* or *minimize*, *largest* or *smallest*, and *greatest* or *least*.

Step 2. Define the variables that affect the quantity to be optimized. Identify any restrictions on these variables.

Step 3. Write a system of linear inequalities to describe all the constraints of the problem. Graph the system.

Step 4. Write an objective function to represent the relationship between the variables and the quantity to be optimized.

HOMEWORK...

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NOTE:

Create a model means graph the solution region

Attachments

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