**Optimization of a Function**

* Optimization involves determining the best result (vertex) of the polygon of constraint
* The optimal answer will either produce a maximum or minimum depending on the type of problem
* If there is more than one answer (vertex) that optimizes the situation, then every point along that line is considered an answer as well.

**Example #1**

X ≥ 1

Y ≤ 5

3y ≥ x

Y ≤ -x + 6

**Step 1 – Make sure all the inequalities are in function form (y=ax+b)**



X ≥ 1



Y ≤ 5



3y ≥ x y ≥ $\frac{1}{3}$x + 0



Y ≤ -1x + 6

**Step 2 – Graph the inequalities & shade the common area**

X ≥ 1

Y ≤ 5

y ≥ $\frac{1}{3}$x

Y ≤ -x + 6

A

B

C

**Step 3 – Determine the coordinates of your vertices using a system of equations (comparison method)**

Vertex A is a given because x = 1 and y = 5 ,therefore the vertex A is (1,5)

**Vertex B**

Y ≥ $\frac{1}{3}$x & Y ≤ -x + 6

$\frac{1}{3}$x = -x + 6

Make equations equal to one another

$\frac{1}{3}$x + x = 6

LOL (Letters on Left) – Numbers on Right

$\frac{4}{3}$ x= 6

Solve for x

$\frac{\frac{4}{3} }{\frac{4}{3} }$ x= $\frac{6}{\frac{4}{3} }$

X = 4.5 or $\frac{9}{2}$

Y ≤ -x + 6

Y ≤ -(4.5) + 6

Plug “x” into one of the equations

Y ≤ -4.5 + 6

Y ≤ 1.5

Vertex B is located at (4.5, 1.5)

**Vertex C**

Y ≥ $\frac{1}{3}$x & X ≥ 1

Since you have x ≥ 1

Plug the value of x into the other equation to solve for y

Y ≥ $\frac{1}{3}$x

Y ≥ $\frac{1}{3}$(1)

Y ≥ $\frac{1}{3}$

Vertex C is located at (1, $\frac{1}{3}$)

**Step 4 – Determine the optimal value (min or max) using the optimizing function**

Example of an optimizing function Revenue = 3x + 8y

|  |  |
| --- | --- |
| **Vertices** | **Revenue = 3x + 8y** |
| A (1,5) | 3(1) + 8(5) = 43 |
| B (4.5, 1.5) | 3(4.5) + 8(1.5) = 25.5 |
| C (1, $\frac{1}{3}$) | 3(1) + 8($\frac{1}{3}$) = 5.$\overbar{6}$ |

**Example #2**

Y ≤ 3x – 3

Y ≥ $\frac{-1x}{2}$ + 4

Y ≥ $\frac{2x}{3}$ – 3

Y ≤ $\frac{-1x}{2}$ + 7.5

**Step 1 – Make sure all the inequalities are in function form (y=ax+b)**

Y ≤ 3x – 3

Y ≥ $\frac{-1x}{2}$ + 4

Y ≥ $\frac{2x}{3}$ – 3

Y ≤ $\frac{-1x}{2}$ + 7.5

**Step 2 – Graph the inequalities & shade the common area**

A

D

B

C

**Step 3 – Determine the coordinates of your vertices using a system of equations (comparison method)**

Vertex A

Y ≤ 3x – 3 & Y ≤ $\frac{-1x}{2}$ + 7.5

3x – 3 = $\frac{-1x}{2}$ + 7.5

3x + $\frac{1x}{2}$ = 7.5 + 3

$\frac{7x}{2}$ = $\frac{10.5}{1}$

7x • 1 = 2 • 10.5

7x = 21

X = 3

Y ≤ 3x – 3

Y ≤ 3(3) – 3

Y ≤ 9 – 3

Y ≤ 6

A (3,6)

Find the coordinates of B, C and D

**Step 4 – Determine the optimal value (min or max) using the optimizing function**

|  |  |
| --- | --- |
| Vertex | R = 3x + 6y |
| A (3,6) | 3(3) + 6(6) = 45 |
| B (9,3) | 3(9) + 6(3) = 45 |
| C (6,1) | 3(6) + 6(1) = 24 |
| D (2,3) | 3(2) + 6(3) = 24 |

Because 2 points produce a optimal (maximum) revenue, the answer will be ALL points on the line between points A and B

\*go look at all the graph and pick out ALL the points between A and B (including A and B)\*

A

B