MATH SPEAK - TO BE UNDERSTOOD AND MEMORIZED

1) **OPTIMIZATION PROBLEM** = a real life situation analyzed using the concepts of ***linear equations*** and ***systems of inequalities*** in order to determine the maximum or minimum quantity necessary quantity such as revenue, costs or the number of wing-nuts produced.

2) **CONSTRAINT** = a ***linear inequality*** that represents a limitation to the ***variables*** in the real life situation.

3) **OBJECTIVE FUNCTION** = a ***linear equation*** used to answer the ***question*** found in the ***optimization problem***.

OPTIMIZATION PROBLEMS

I) ***An OPTIMIZATION PROBLEM is a real life situation analyzed using the concepts of linear equations and systems of inequalities in order to determine the maximum or minimum quantity necessary quantity such as revenue, costs or the number of wing-nuts produced.***

A) To solve an ***optimization problem*** you are required to create a ***system of linear inequalities*** and list their ***restrictions***.

1) The ***inequalities*** are called ***constraints*** because they describe the limits, ***constraints***, to the real life situation.

2) The ***restrictions*** are the limits to the numbers ($\mathbb{N}$, W, I, $\mathbb{R}$) that can be considered as possible solutions to the problem. These ***DOMAIN*** and ***RANGE restrictions*** are determined by considering the kinds of things produced or consumed in the problem. **i.e.** ***restrictions*** $x \in \mathbb{N}$

REMEMBER: ***Constraints*** and ***restrictions*** are different. ***Constraints*** are ***linear inequalities*** describing the real life situation while ***DOMAIN*** and ***RANGE restrictions*** are mathematical limits to the numbers that can be considered as possible solutions to the problem. **i.e.** ***constraint:*** $y \le 5x + 37$ ***;*** ***restrictions*** $x \in \mathbb{N},\ y \in \mathbb{N}$

II) ***SOLVING OPTIMIZATION***

A) An ***optimization problem*** is solved by creating a ***mathematical model***, which includes ***variables***, a ***linear equation***, ***restrictions***, a ***system of constraints*** (***linear inequalities***), and a ***graph***. The ***model*** is then used to answer the question given in the problem.

1) The ***graph*** will have an ***overlapping shaded area*** that is confined by the boundaries of the ***constraints*** and or the ***horizontal*** and ***vertical axes***. The coordinates of the ***corner points*** of the ***overlapping shaded area*** are the possible solutions to the ***optimization problem***.

B) **USE THESE STEPS TO SOLVE *OPTIMIZATION PROBLEMS***

1: ***Define the VARIABLES for the objects described in the problem.***
2: ***Write the OBJECTIVE FUNCTION (linear equation) needed to answer the question.***
3: ***Write the DOMAIN and RANGE restrictions.***
4: ***Write the CONSTRAINTS (system of linear inequalities).***
5: ***Graph the CONSTRAINTS (system of linear inequalities).***
6: ***List the coordinates of each INTERSECTION (corner points). You may have to calculate them using the graphing calculator.***
7: ***Substitute the coordinates of each INTERSECTION (corner points) into the OBJECTIVE FUNCTION (linear equation) to answer the question.***

C) ***SAMPLE PROBLEMS 1:*** Study these examples carefully. Be sure you understand and memorize the process used to complete them.

1) Answer the problem given in **EXAMPLE 2** on page 338 of your text.

1: ***Define the VARIABLES for the objects described in the problem.***

Let C =

Let n =

Let w =

Continued on the next page.

2: ***Write the OBJECTIVE FUNCTION (linear equation) needed to answer the question.***

3: ***Write the DOMAIN and RANGE restrictions.***

4: ***Write an inequality that describes the relationship between the variables.***

5: ***Graph the CONSTRAINTS (system of linear inequalities).***

5a: ***Graph the first constraint.***

5b: ***Graph the second constraint.***

5c: ***Graph the third constraint.***

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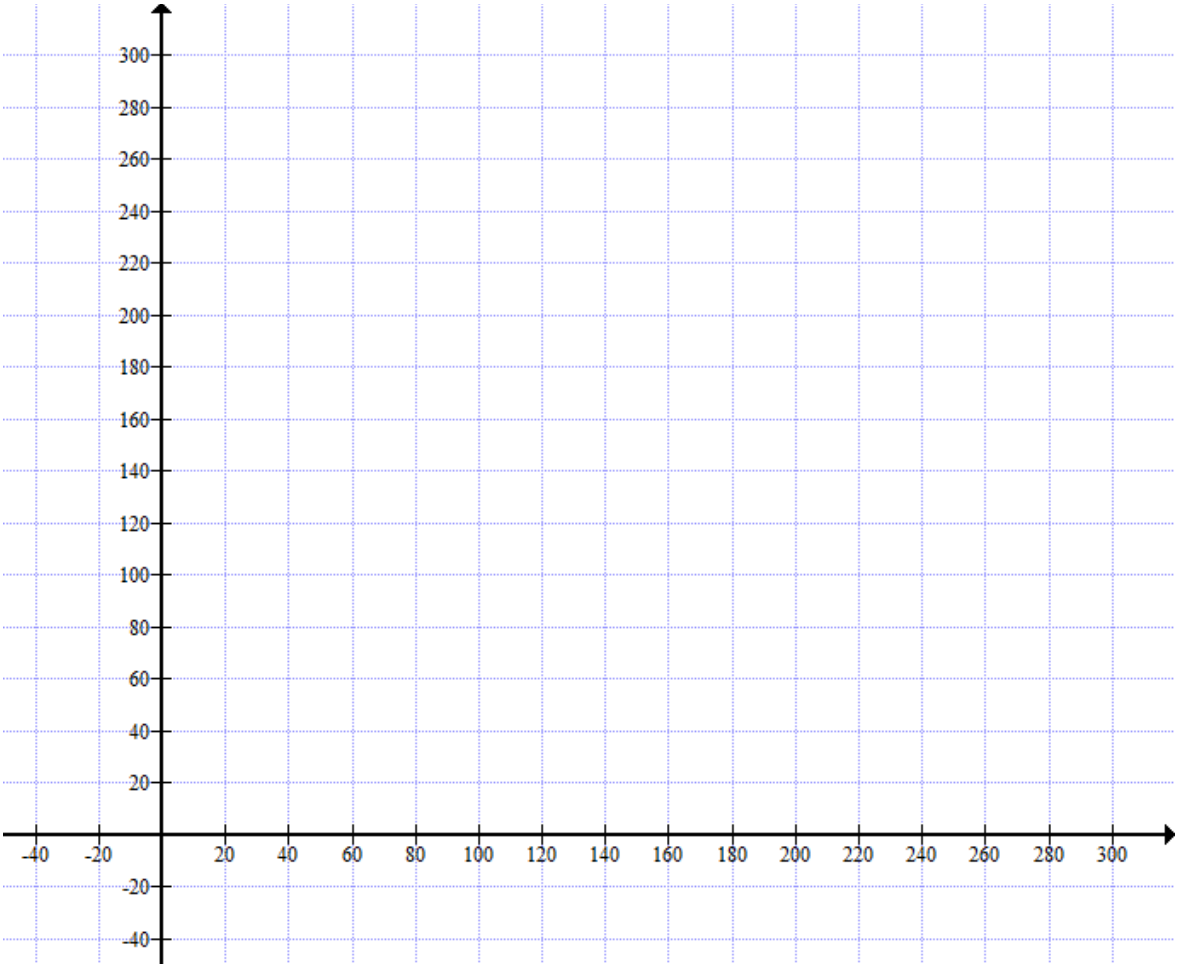


6: ***List the coordinates of each INTERSECTION (corner points). You may have to calculate them using the graphing calculator.***

7: ***Substitute the coordinates of each INTERSECTION (corner points) into the OBJECTIVE FUNCTION (linear equation) to answer the question.***

2) Answer the problem given in **EXAMPLE 2** on page 327 of your text.

1: ***Define the VARIABLES for the objects described in the problem.***

Let R = the daily revenue

Let g = litres of gasoline produced

Let h = litres of heating oil produced

2: ***Write the OBJECTIVE FUNCTION (linear equation) needed to answer the question.***

3: ***Write the DOMAIN and RANGE restrictions.***

4: ***Write an inequality that describes the relationship between the variables.***

5: ***Graph the CONSTRAINTS (system of linear inequalities).***

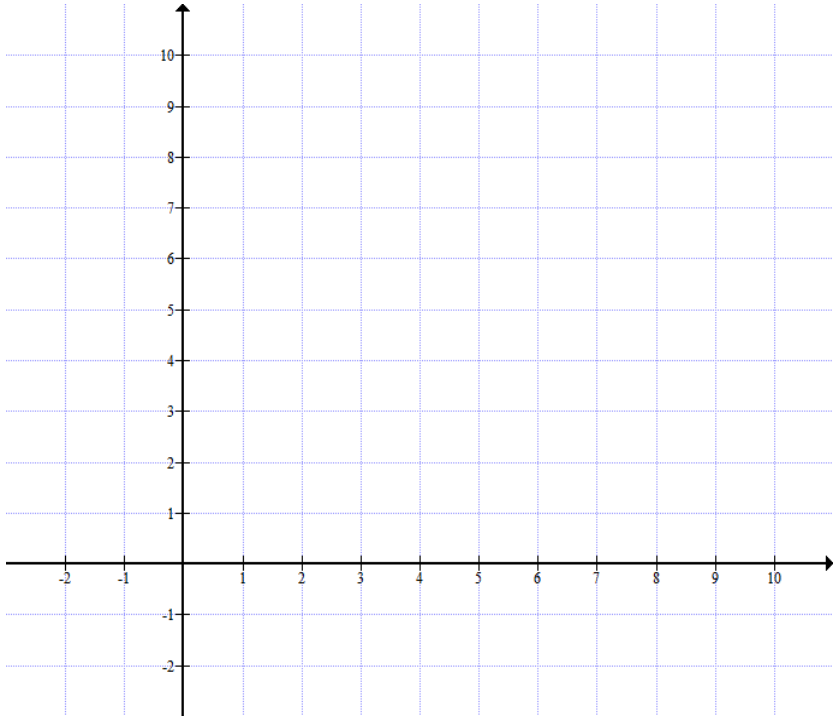
5a: ***Graph the first constraint.***

5b: ***Graph the second constraint.***

5c: ***Graph the third constraint.***

Continued on the next page.

Because the ***DOMAIN*** and ***RANGE restrictions*** are ***Real numbers larger than zero***
$g \in \mathbb{R},\ h \in \mathbb{R}$ where $g \geq 0,\ h \geq 0$ the ***overlapping shaded area is*** **NOT** ***stippled***.



6: ***List the coordinates of each INTERSECTION (corner points). You may have to calculate them using the graphing calculator.***

7: ***Substitute the coordinates of each INTERSECTION (corner points) into the OBJECTIVE FUNCTION (linear equation) to answer the question.***

D) ***REQUIRED PRACTICE 2:*** Complete these problems: Page 342-46: Questions 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 & 15. **SHOW THE PROCESS!!** **{Ans.** Page 562-563**}**