**Lesson 2.5 – Optimizing Areas & Perimeters**

***Goal: Determine the optimal perimeter and area for 2-dimensional figures***

**Optimization:** The process of finding the most efficient use of available materials within given constraints.

***Key Concepts***

1. Among all rectangles with a given perimeter, a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ has the ***maximum*** area
2. Among all rectangles with a given area, a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ has the ***minimum*** perimeter

***EXAMPLE 1***

What dimensions produce an optimal area of a rectangle with perimeter 20 m? What is the maximum area?

***EXAMPLE 2***

What dimensions produce an optimal perimeter of a rectangle with area 45 m2? What is the minimum perimeter?

***Optimizing with Restrictions***

It may not be possible to form a square because of certain restrictions. Restrictions such as:

* The length and width need to be whole numbers
* One or more sides are enclosed by natural boundaries (house, pond, etc.)

***EXAMPLE 3***

A rectangular garden is to be fenced using the wall of a house as one side of the garden. The garden should have an area of 40 m2. Determine the minimum perimeter and dimensions of the garden if:

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| 1. The dimensions must be whole meters  |  |  |  | | --- | --- | --- | | ***l*** | ***w*** | ***P*** | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | | 1. The dimensions can be decimals |

When there are restrictions such as the above and a square cannot be formed the optimal shape will occur when the: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***EXAMPLE 4***

Ngaio has 28 m of fencing to build a pen for her dog. She plans to build the pen along one wall of her house as shown? What are the dimensions of the pen with the greatest area?

**Enclosing non-rectangular areas:**

***EXAMPLE 5***

A farmer is creating a fenced exercise yard for her horses. She has 900m of flexible fencing and wishes to maximize the area. She is going to fence a rectangular or circular area. Determine which encloses the greatest area.