Applications of Perimeter and Area---Optimization Investigation

Maximizing Area for a Given Perimeter

Example 1: Farmer Pooley wants to buy some pigs. He needs to build a fenced area for the pigs and only has 40m of fencing. He wants to build a rectangular pen that will give the pigs the maximum amount of space. What dimensions should the pen be?

Solution:
Using the grid paper below, draw as many rectangles as you can that only use 40m of fencing.

For each drawing, fill in the chart below:

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<thead>
<tr>
<th>Design Number</th>
<th>Perimeter (m)</th>
<th>Length (m)</th>
<th>Width (m)</th>
<th>Area (m²)</th>
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Conclusions:
What is the greatest area for the pig pen that has a perimeter of 40m? ________________
What are the dimensions of the rectangle with the greatest area? ________________
What shape is the pig pen? ________________

Formula: Dimensions of the shape with Maximum Area given a set Perimeter:
Length = ________________
Width = ________________
Maximizing Area for a Given Perimeter – 3 sided

Example 2: Farmer Pooley wants to fence off a rectangular area beside the chicken coop. He only needs to put up 3 sides of fencing since the chicken coop will act as the fourth side. He has 20 m of fencing and wants to maximize the space for the chickens. What dimensions should the pen be?

Solution:
Using the grid paper below, draw as many rectangles as you can that only use 20 m of fencing.

For each drawing, fill in the chart below:

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Conclusions:
What is the greatest area for the 3 sided pen that has a perimeter of 20 m? ________________
What are the dimensions of the rectangle with the greatest area? ________________
What shape is the chicken pen? ________________

Formula: Dimensions of the shape with Maximum Area given a set 3 sided Perimeter:
Length = _________________________________
Width = _________________________________
Minimizing Perimeter for a Given Area

Example 3: Farmer Pooley is running out of money. He needs to build a fenced area for his pigs and wants to spend as little as possible on fencing. He wants to build a rectangular pen with an area of 16m². What dimensions should the pen be?

Solution:
Using the grid paper below, draw as many rectangles as you can that have an area of 16m².

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Conclusions:
What is the least amount of fencing needed for a 16m² pen? ____________________________
What are the dimensions of the rectangle with the least perimeter? ___________________
What shape is the pig pen? ____________________________

Formula: Dimensions of the shape with Minimum Perimeter given a set Area:
Length = __________________________________________
Width = ____________________________________________
Minimizing Perimeter for a Given Area – 3 sided

Example 4: Farmer Pooley wants to fence off a rectangular area beside the chicken coop. He only needs to put up 3 sides of fencing since the chicken coop will act as the fourth side. He wants the pen to be 18m². What dimensions should the pen be in order to minimize fencing costs?

Solution:
Using the grid paper below, draw as many rectangles as you can that only use 18m² of fencing.

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Conclusions:
What is the least amount of fencing for the 3 sided pen that has an area of 18m²? __________
What are the dimensions of the rectangle with the least perimeter? _______________________
What shape is the chicken pen? ____________________________

Formula: Dimensions of the shape with Minimum 3 sided Perimeter given a set Area:
Length = ______________________________________________________
Width = _______________________________________________________