Optimization Problems

Optimization is the process of *maximizing* (making as large as possible) or *minimizing* (making as small as possible) a value according to some conditions.

Examples

Optimizing the use of your **money** might mean getting the most you can for the money you have.

Optimizing your use of **paint** might mean using the smallest amount of paint while still covering the surface.

Optimizing the use of your **time** might mean getting the most accomplished with the time you have available.

A measurement example

Suppose you have a rectangle with a perimeter of 16 units. What is the **maximum** area it could have? *Find the maximum area for a rectangle with perimeter 16 units. This is **optimizing the area**.*

What are all the different combinations of dimensions it could have?

Width (w)	Length (l)	Area (A)

What is the maximum area?

What shape gives the maximum area?

Another example

Suppose instead that you have a rectangle that has an area of 24 square units. Find the smallest perimeter the rectangle could have. *Find the minimum perimeter for a rectangle with area 24 units. This is* ***optimizing the perimeter****.*

What are all the different combinations of dimensions it could have?

Width (w)	Length (l)	Perimeter (P)

What is the minimum perimeter?

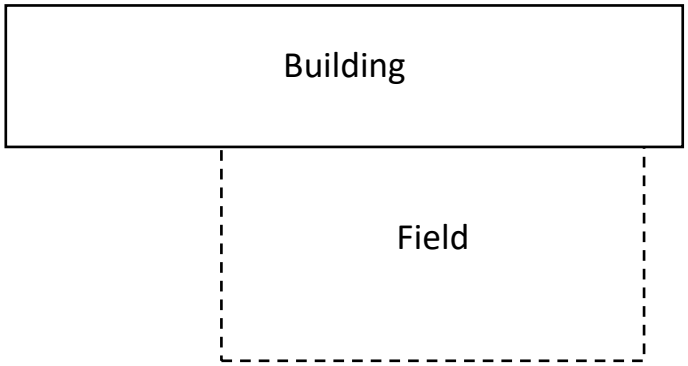
What shape gives the minimum perimeter?

What if the length and width were not integers?

Yes, another example

Suppose a fence is being built alongside a building to surround a rectangular field. The field with only require fencing on three sides, since the building is a barrier on the fourth side.

If the total amount of fencing is 16 metres, what dimensions will maximize the area of the field?



Width (w)	Length (l)	Area (A)

Stuff we noticed

Given a fixed perimeter, the rectangle that maximizes area…

Given a fixed area, the rectangle that minimizes perimeter…

Given a fixed area, the rectangle that minimizes perimeter on three sides…

Given a fixed perimeter on three sides, the rectangle that maximizes area…

Practice

Find the maximum area for a rectangle with perimeter $169\ \mathrm{m}$.

Find the minimum perimeter for a rectangle with area $81\ \mathrm{cm}^2$.

Optimize the area for a rectangle with perimeter $1\ \mathrm{km}$.

Find the smallest perimeter required to fence an area of $200\ \mathrm{m}^2$ on three sides.

Optimize the perimeter for a rectangle with area $13\ \mathrm{cm}^2$.