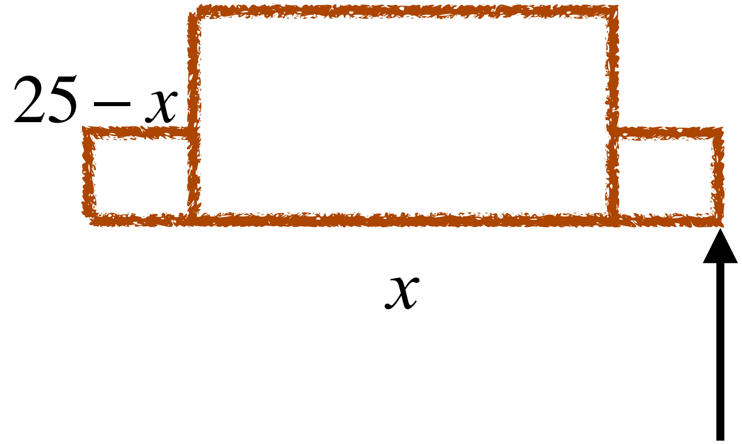
3-5 Optimization

Finding Optimum Values

You have 50 feet of fence to enclose a rectangular garden. What is the maximum area that you can enclose?



$$w = x$$

$$P = 50 = 2x + 2l$$

$$2l = 50 - 2x$$

$$l = \frac{50-2x}{2} = 25 - x$$

$$A(x) = lw = (25-x)x$$

Consider $A(x)$ to be the area formula as a function of x.

What is the domain?

$$0 < x < 25 \ \ feet$$ Why?

Imagine the length being very small, almost 0

If the perimeter is 50, what value would x approach?

Because there is an x on two sides of the garden each value would max out at 25 feet.

You have 50 feet of fence to enclose a rectangular garden. What is the maximum area that you can enclose?

$$w = x$$

$25 - x$

x

$$P = 2w + 2l$$

$$50 = 2x + 2(50 - 2x)$$

$$l = \frac{50 - 2x}{2} = 25 - x$$

$$A(x) = lw = (25 - x)x$$

Consider $A(x)$ to be the area formula as a function of x.

What is the domain?

$$0 < x < 25 \;\; feet$$

How do we find the maximum value of $A(x)$?

$$A(x) = 25x - x^2$$

$$A'(x) = 25 - 2x$$

Take the *derivative!*

$$0 = 25 - 2x$$

Set it to zero and solve for x.

$$x = 12.5 \;\; feet$$

Since $x = 0, 25$ would give us $A(x) = 0$, this value must give a local maximum for $A(x)$

You have 50 feet of fence to enclose a rectangular garden. What is the maximum area that you can enclose?

$$l = 12.5 \ \ feet$$

$$w = 12.5 \ \ feet$$

Optimization

1. Draw a picture! This can go a long way towards setting up your solution.
2. Write a function for the value that you are trying to optimize.
3. If your function is in terms of more than one variable, use substitution to reduce it to one.
4. Find the domain of this function.
5. Take the derivative and set it to zero to find the extreme points.
6. Determine the maximum/minimum values
7. Check the end points of the domain to determine if either is a max or min.