

## Pre-Calculus: Maximum - Minimum Problems

Questions to ask:

1. Is it a maximum or minimum problem?
2. What is being maximized or minimized?
3. What type of function is needed?
4. What are the critical values?
5. Is it a closed interval?
6. Have you justified the max or min?
7. Have you answered the question?

Example 1:

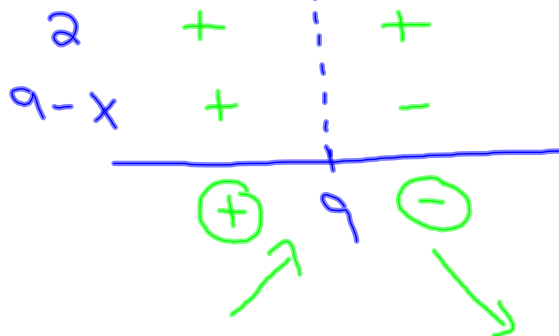
1. Find two numbers whose sum is 18 and product is greatest.

$$P = x \cdot y$$
$$x + y = 18$$
$$y = 18 - x$$

$$P(x) = x(18 - x)$$

$$P(x) = 18x - x^2$$

$$P'(x) = \frac{dP}{dx} = 18 - 2x$$
$$= 2(9 - x)$$



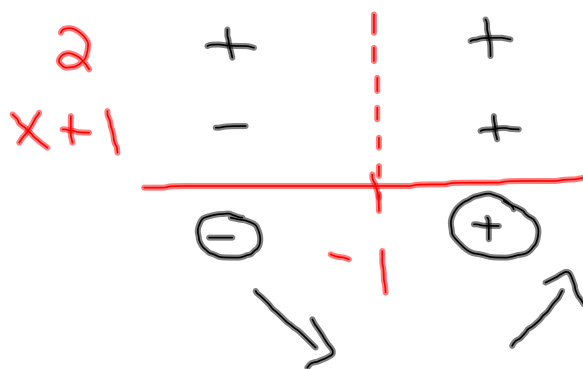
max Product when  $x=9, y=9$

Example 2:

The square of a number is added to twice the number.  
What number will yield the smallest sum?

$$S(x) = x^2 + 2x$$

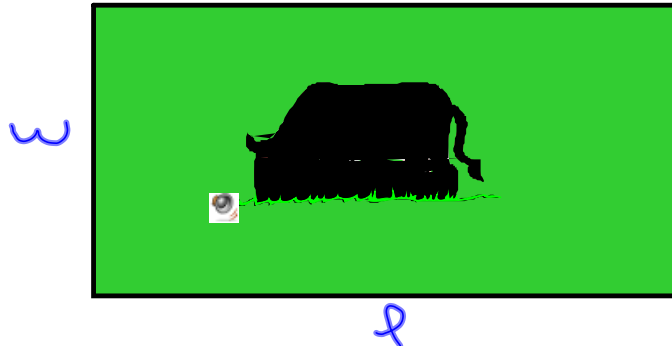
$$S'(x) = 2x + 2$$
$$= 2(x + 1)$$



min sum when  $x = -1$

Example 3:

A rectangular field is to be enclosed with 200 feet of fencing. What dimensions of the field will give the maximum area?

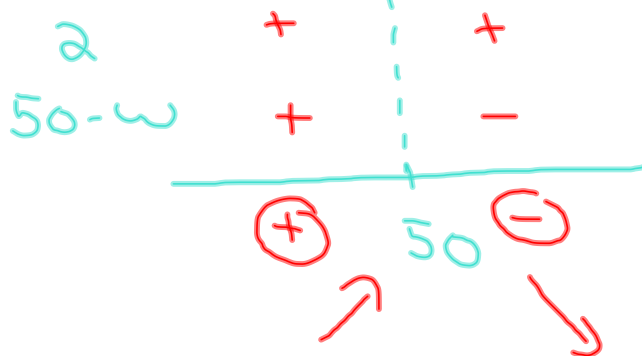


$$A = l \cdot w$$

$$A(w) = w(100 - w)$$

$$A(w) = 100w - w^2$$

$$\frac{dA}{dw} = 100 - 2w$$
$$= 2(50 - w)$$



max area when  $w = 50$ ,  $l = 50$