Ex 1 Find the dimensions of a rectangle with perimeter 20 feet whose area is as large as possible

MAX

Explore "by hand" Idea

$L > 0$
$w > 0$
$L \geq w$

$20 = 2(L+w)$

$L + w = 10$

For now assume L, w are integers $A = L * w$

w	L	Area = L * w
1	9	9
2	8	16
3	7	21
4	6	24
5	5	25
6	4	

$L = w = 5$ feet gave max area

We want to solve with CALCULUS we want L, w real numbers

We know $x + y = 10$

$A = xy$ we want the maximum.

We want only one variable

$x + y = 10$

$-x \quad -x$

$y = 10 - x$ substitute in A

$A = xy = x(10-x)$

$A(x) = x(10-x) = 10x - x^2$

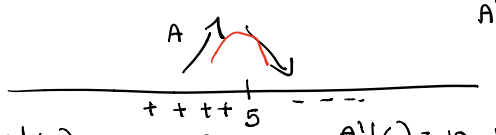
↓ function of x only

$A(x) = 10x - x^2$ want the max Calculus

① $A'(x) = 10 - 2x = 0$ $\quad \frac{10}{2} = \frac{2x}{2}$ $\quad x = 5$ critical point

② Check it is max

$A'(x) = 10 - 2x$



$A'(4) = 10 - 8 = 2 > 0$ $\quad A'(6) = 10 - 12 = -2 < 0$

Since A changes from increasing to decreasing at $x = 5$

$x = 5$ is (local) max

$x = 5$ feet

$y = 5$ feet

$y = 10 - x$

$y = 10 - 5 = 5$

dimensions that give max area

Max area $= 25$ feet^2