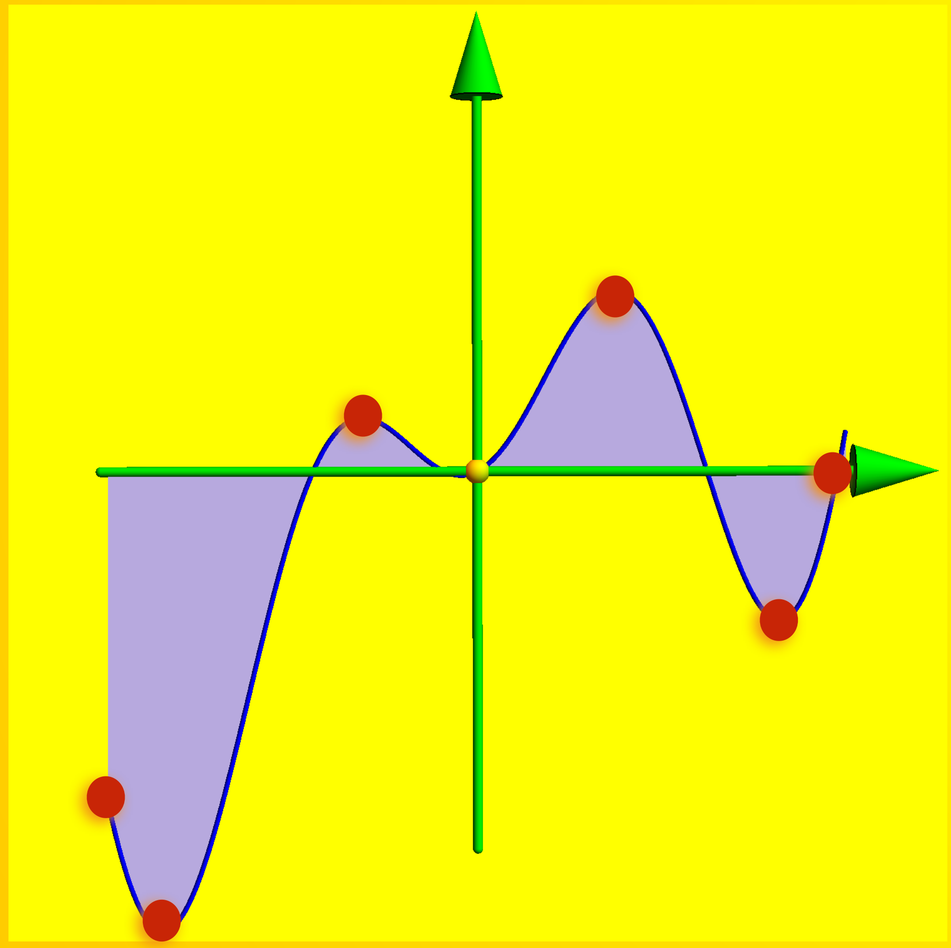
12 Global Extrema



Bolzano theorem

A continuous function f has a maximum and minimum on a closed interval [a,b].

Check local extrema in the interior of the interval and then look at boundary points

PLAN

0. Something about the exam

1. True-False Poll

2. Extremal Value Theorem

3. Harvard Stadium Problem

4. Harvard Statue Problem

5. Mechanic Problem (Jam)

FIRST HOURLY

Friday March 5th

Material until Monday March 1

Practice exams to come.

Format will be announced.

POLL

T F

F T

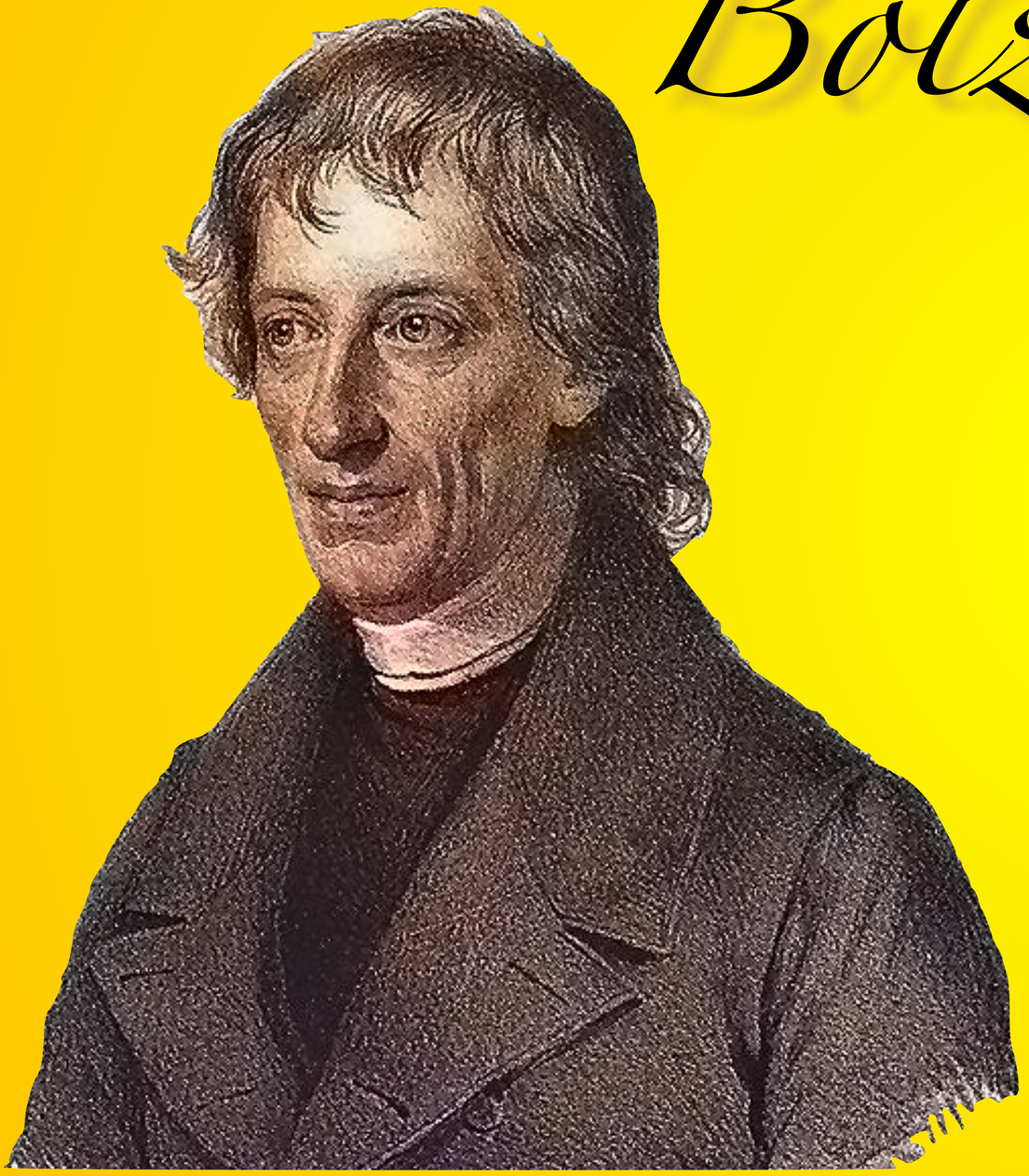
T T

F F

A)If f'(0)=0 and f''(0)>0 then 0 is a minimum

B) If f'(0)=0 and 0 is a minimum, then f''(0)>0

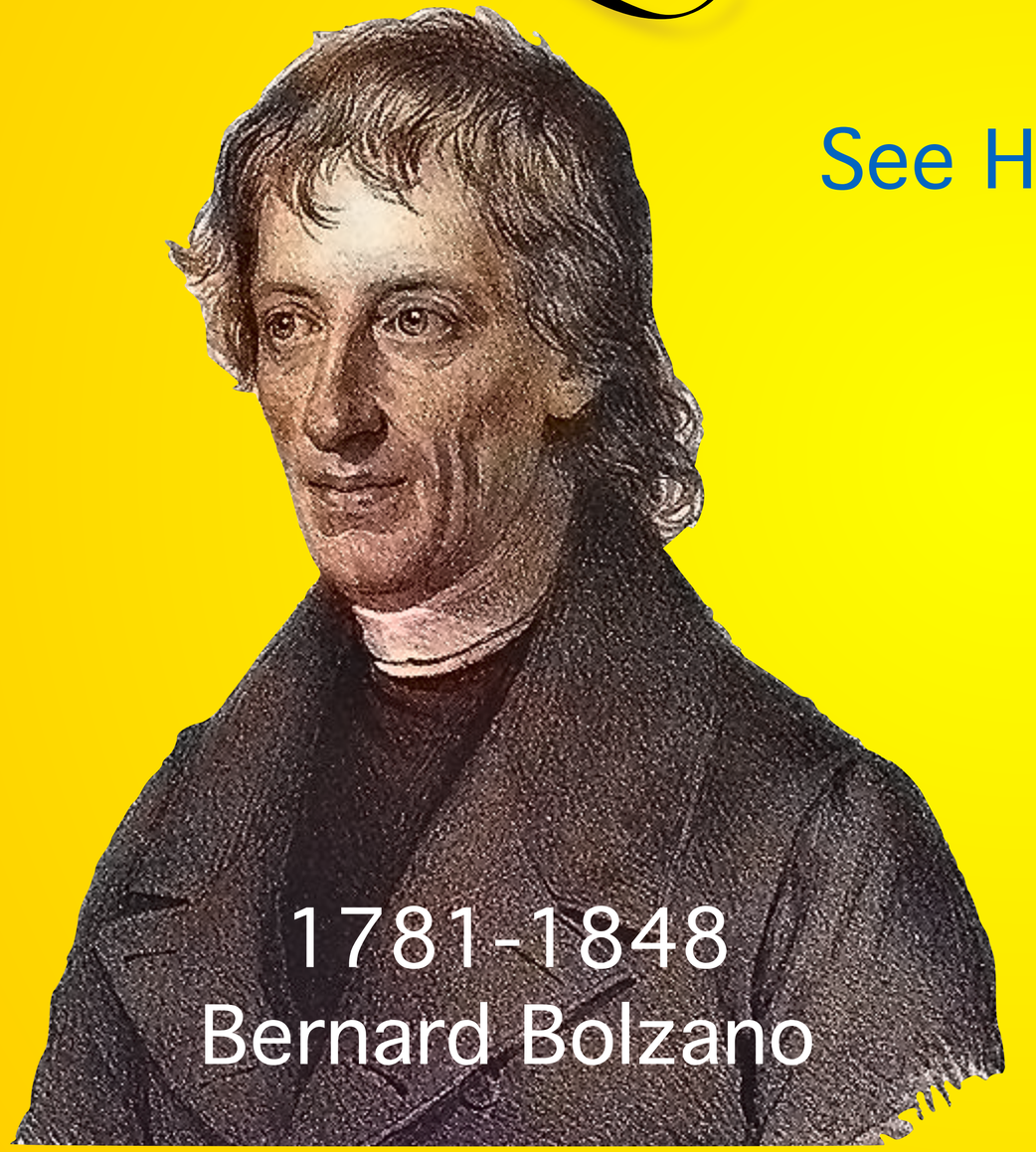
Bolzano Theorem



Extremal Value Theorem: A continuous function on a compact interval has both a global maximum and a global minimum.

Bernard Bolzano
1781-1848

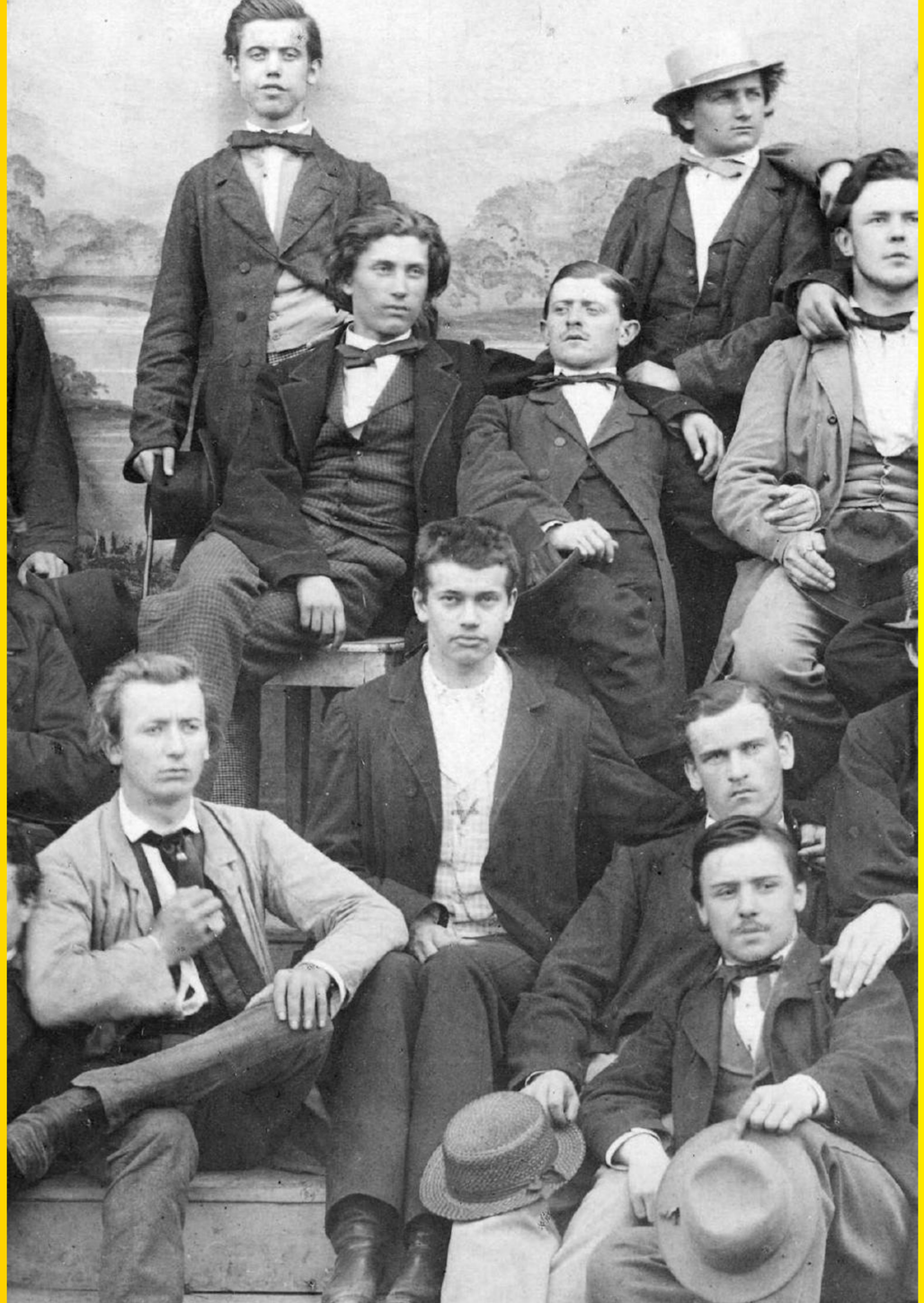
Bolzano - Boltzmann



1781-1848
Bernard Bolzano

See Homework

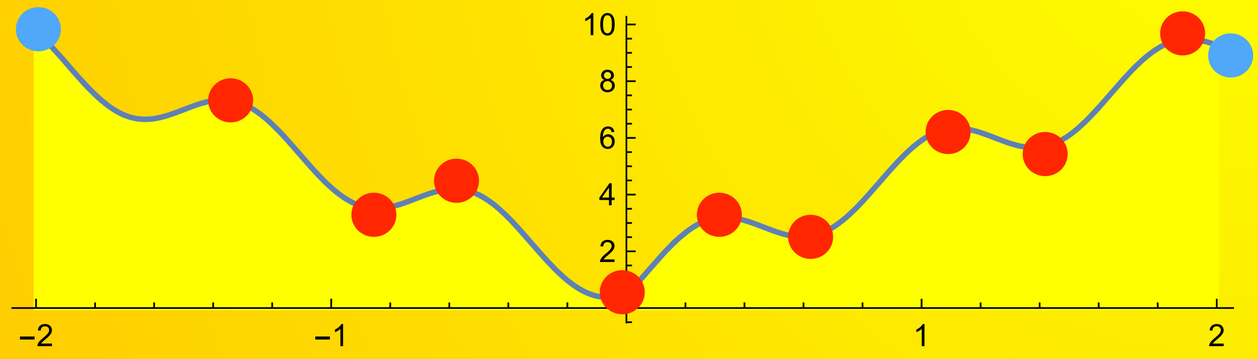
1844-1906
Ludwig Boltzmann



Closed Interval method

Boundary points

Critical points



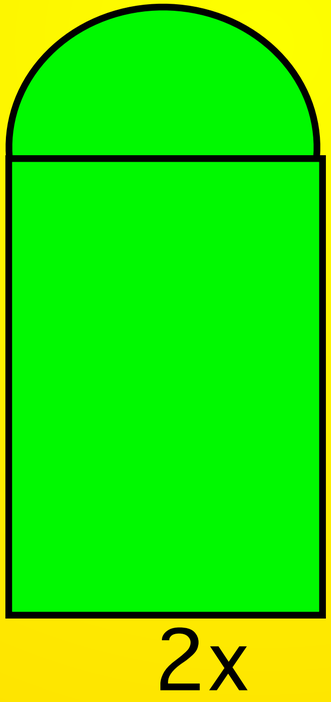
To find a global max on [a,b], list all critical points and boundary points

Soda Problem

Which can of volume $V = \pi r^2 h = 2\pi$
uses minimal material given by the surface
area $A(r) = 2\pi rh + 2\pi r^2$

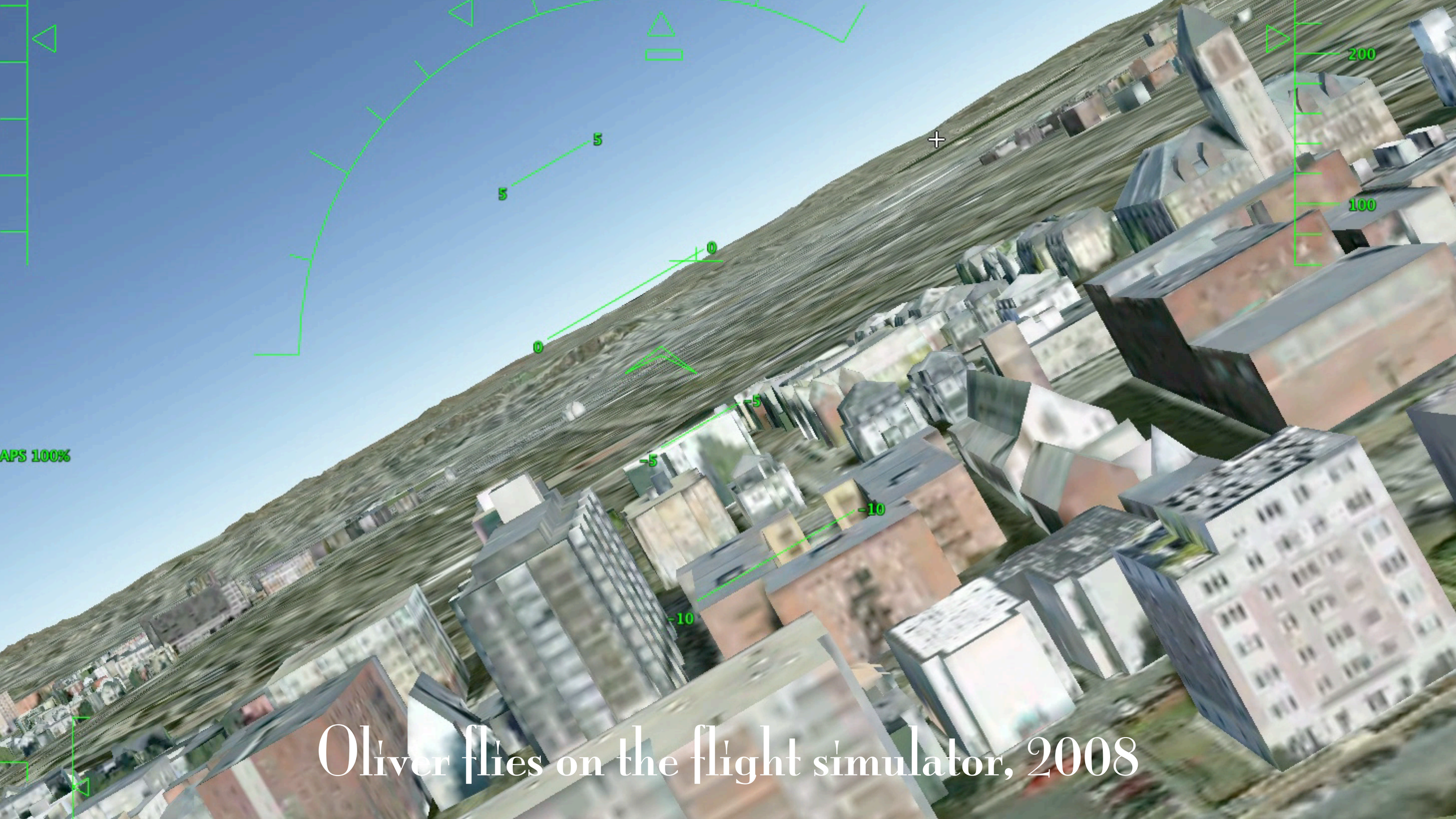
STADIUM PROBLEM

Which stadium of the following geometry has maximal area?



circumference length

$$f(x) = \pi x + 20$$

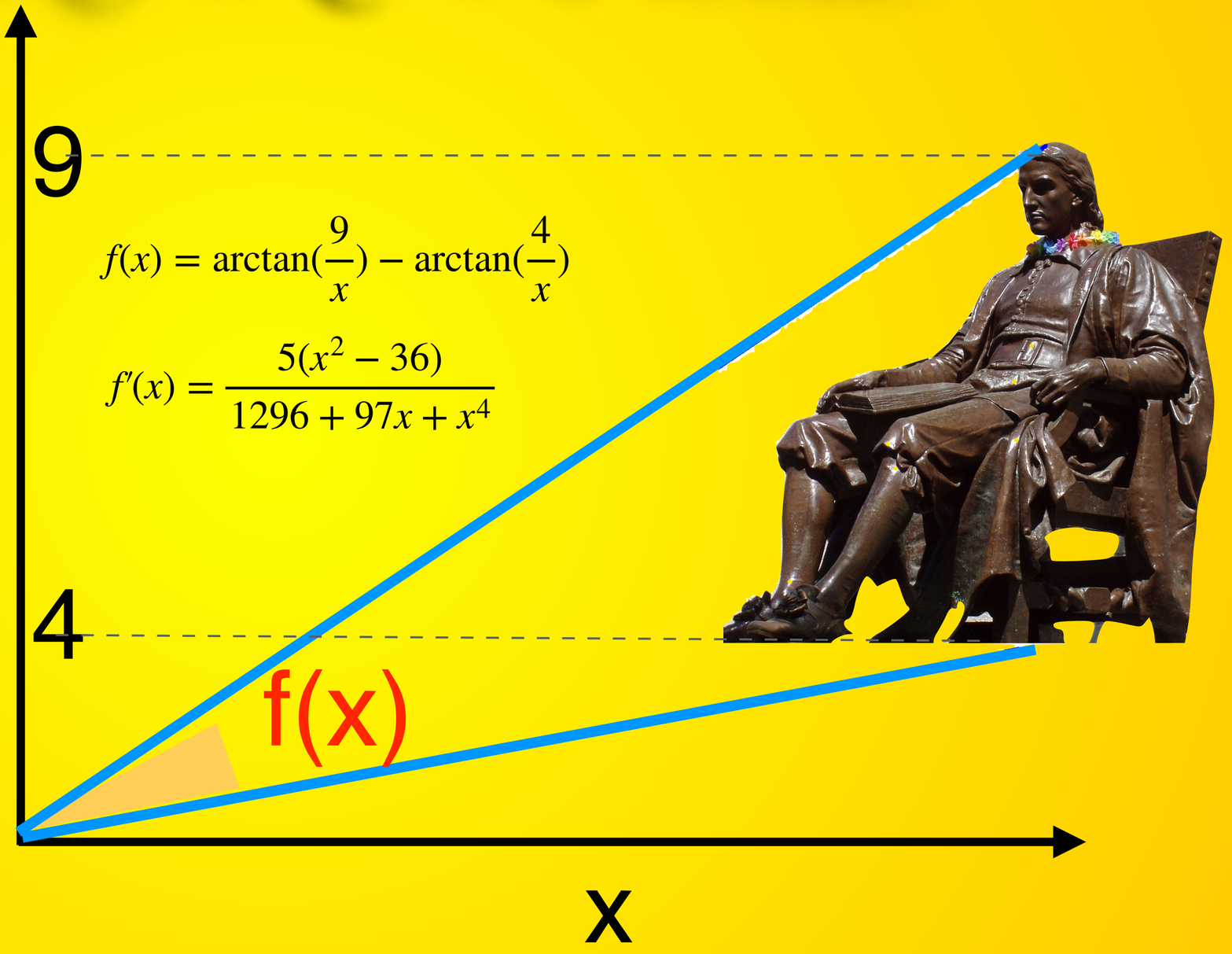


Oliver flies on the flight simulator, 2008

Oliver flies on the flight simulator, 2021

HARVARD STATUE

From which distance x do you see the Harvard Statue best?



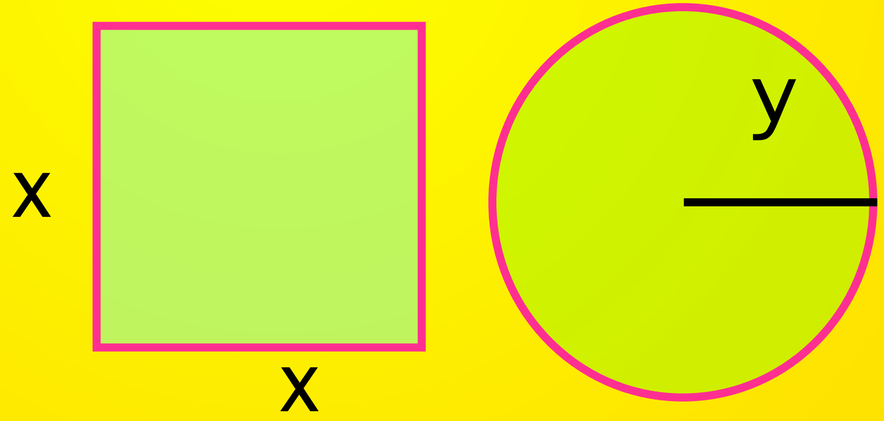
EXPERIMENT 2014

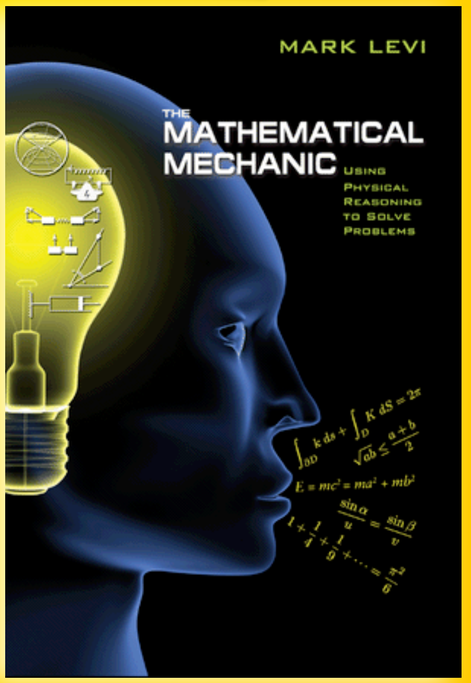
WIRE PROBLEM

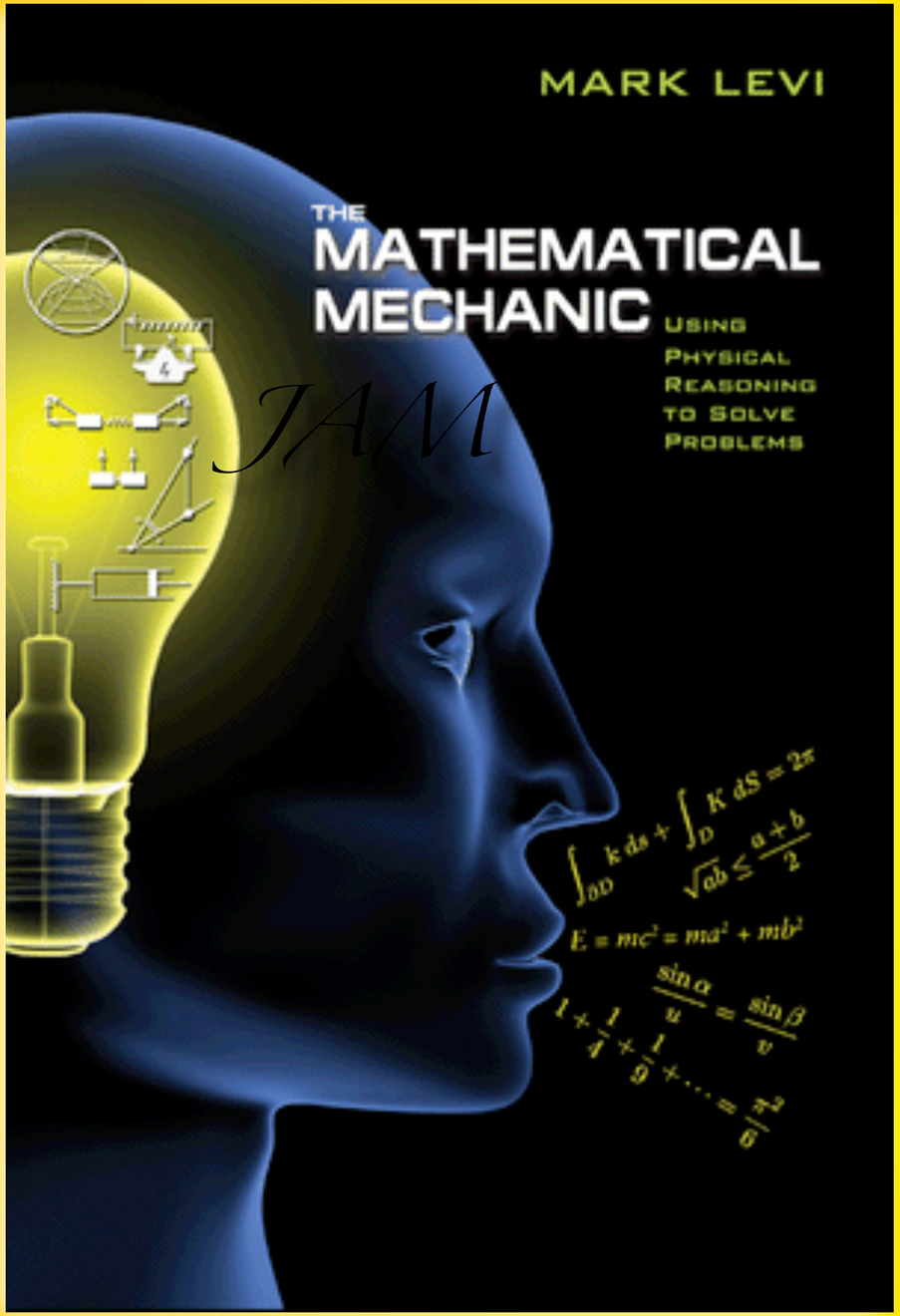
JAM

Maximize the area $x^2 + \pi y^2$

with a total wire length $4x+2\pi\ y=2$







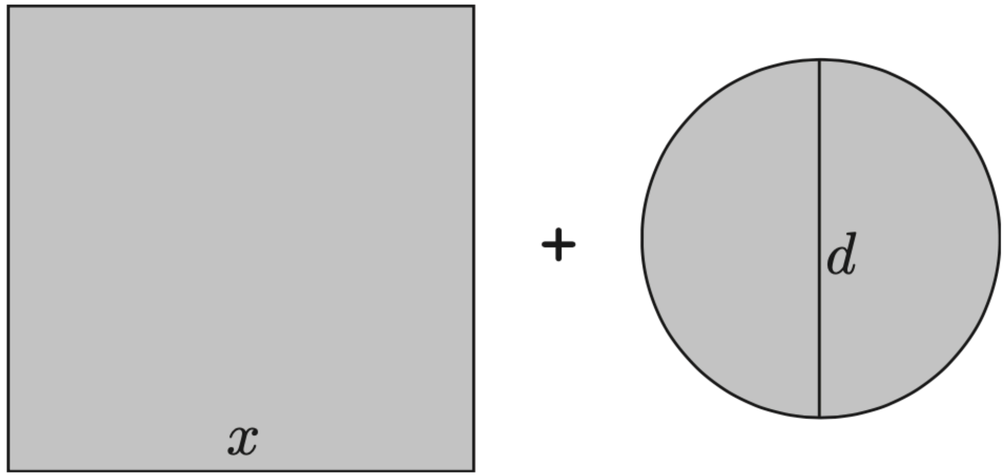


Figure 3.10. Minimize the area given the combined perimeter L.

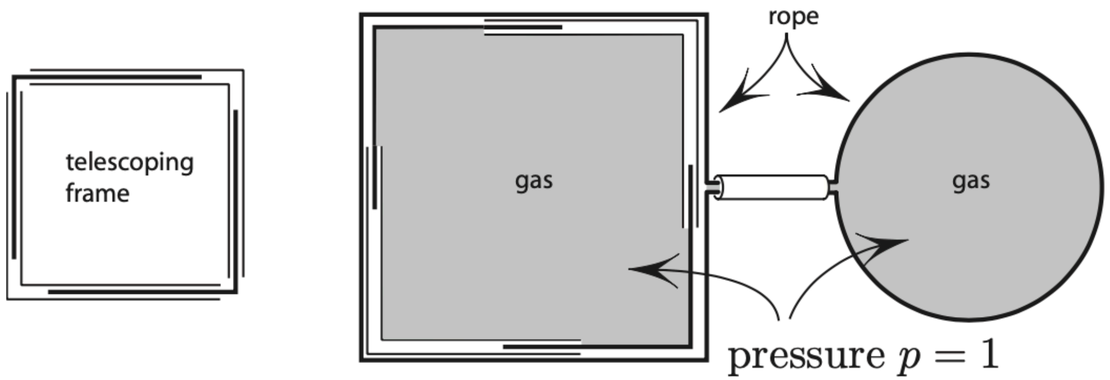


Figure 3.11. The two containers try to expand against the rope's tension.

FROM LEVI:

The End