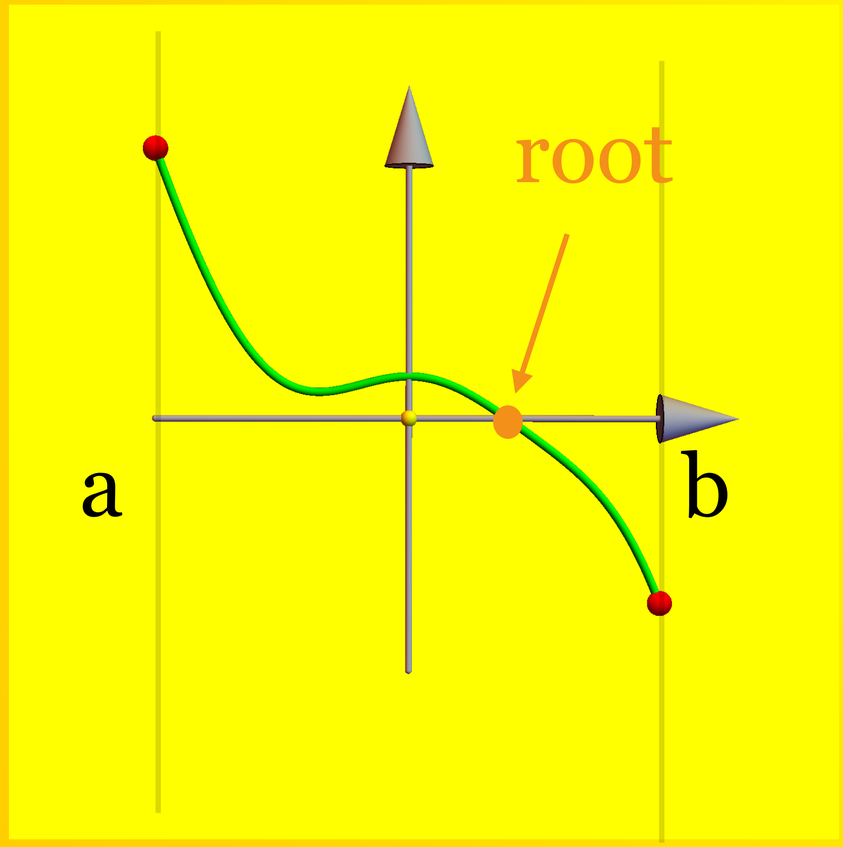
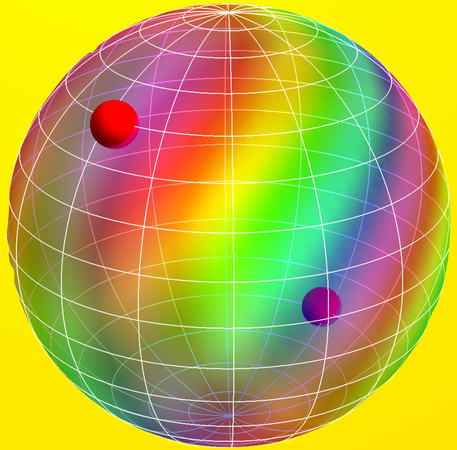
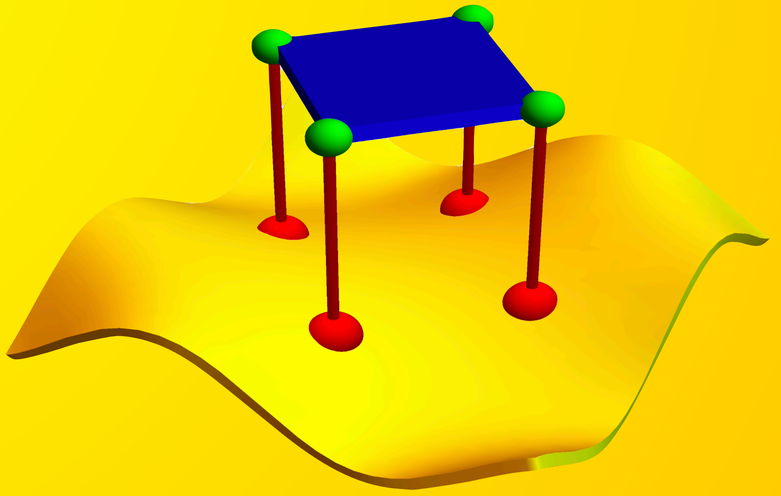
5 IntermediateValue

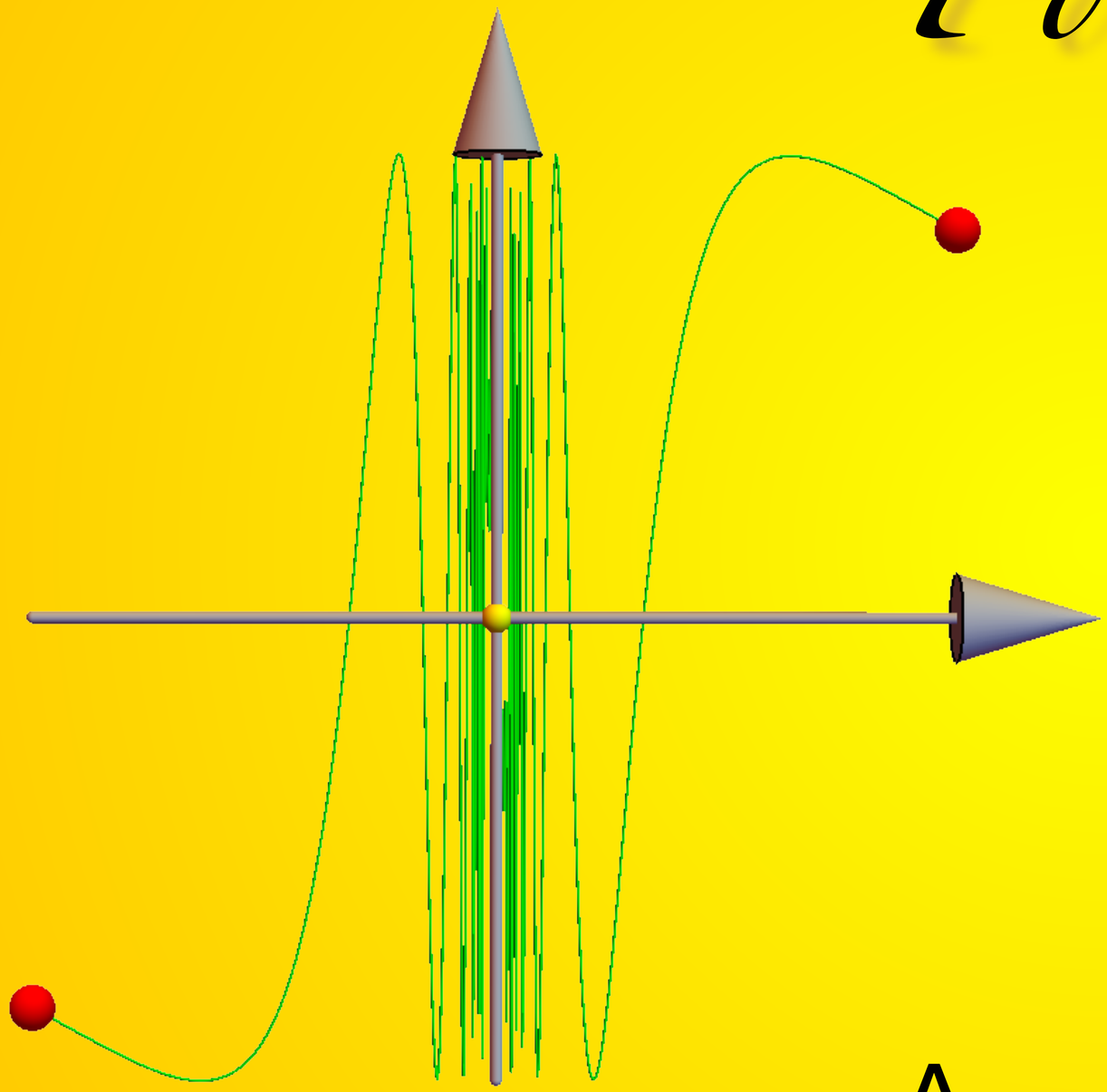
If f is continuous and if f(a)*f(b)<0, then there is a root in (a,b).



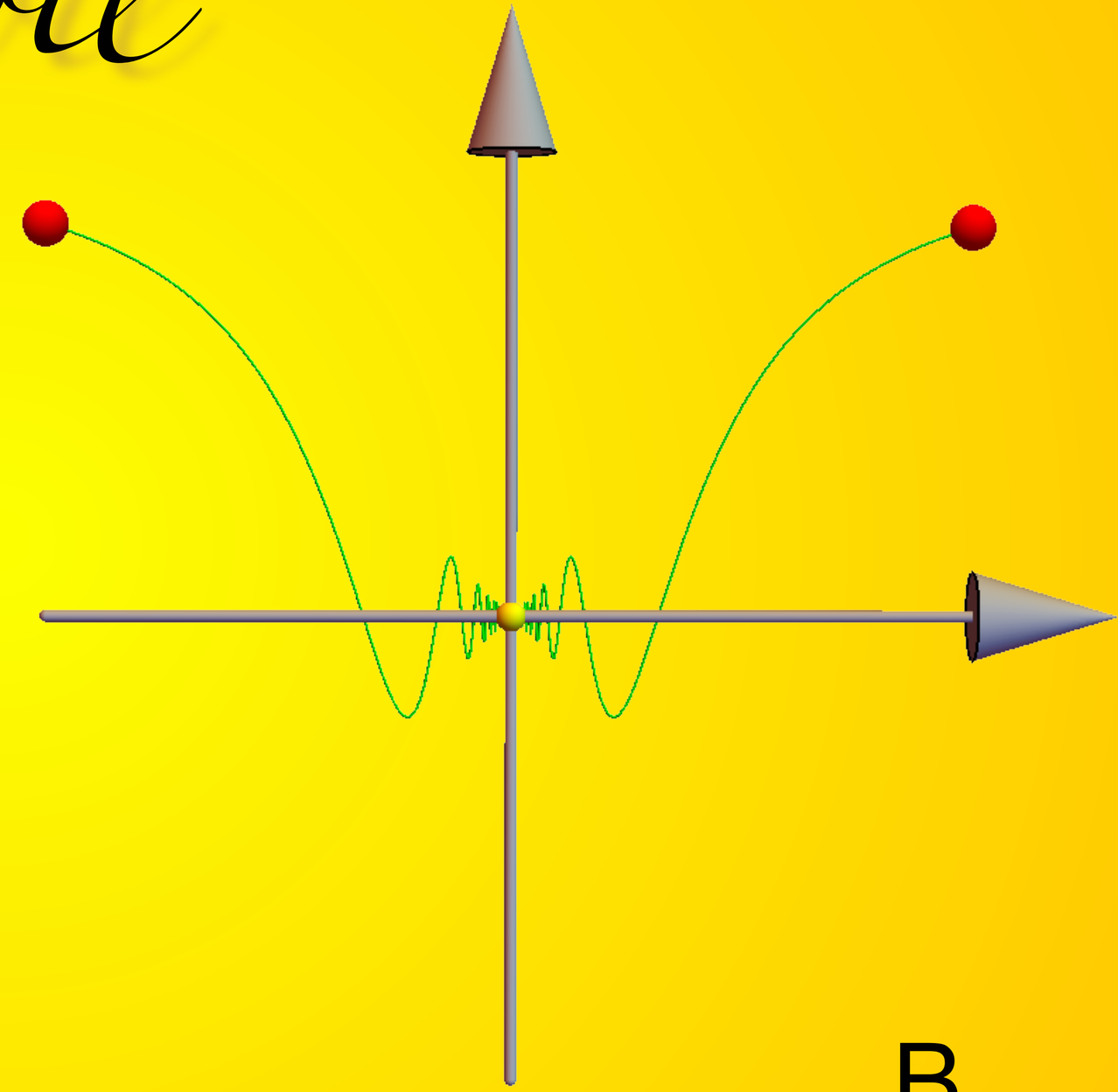




Poll

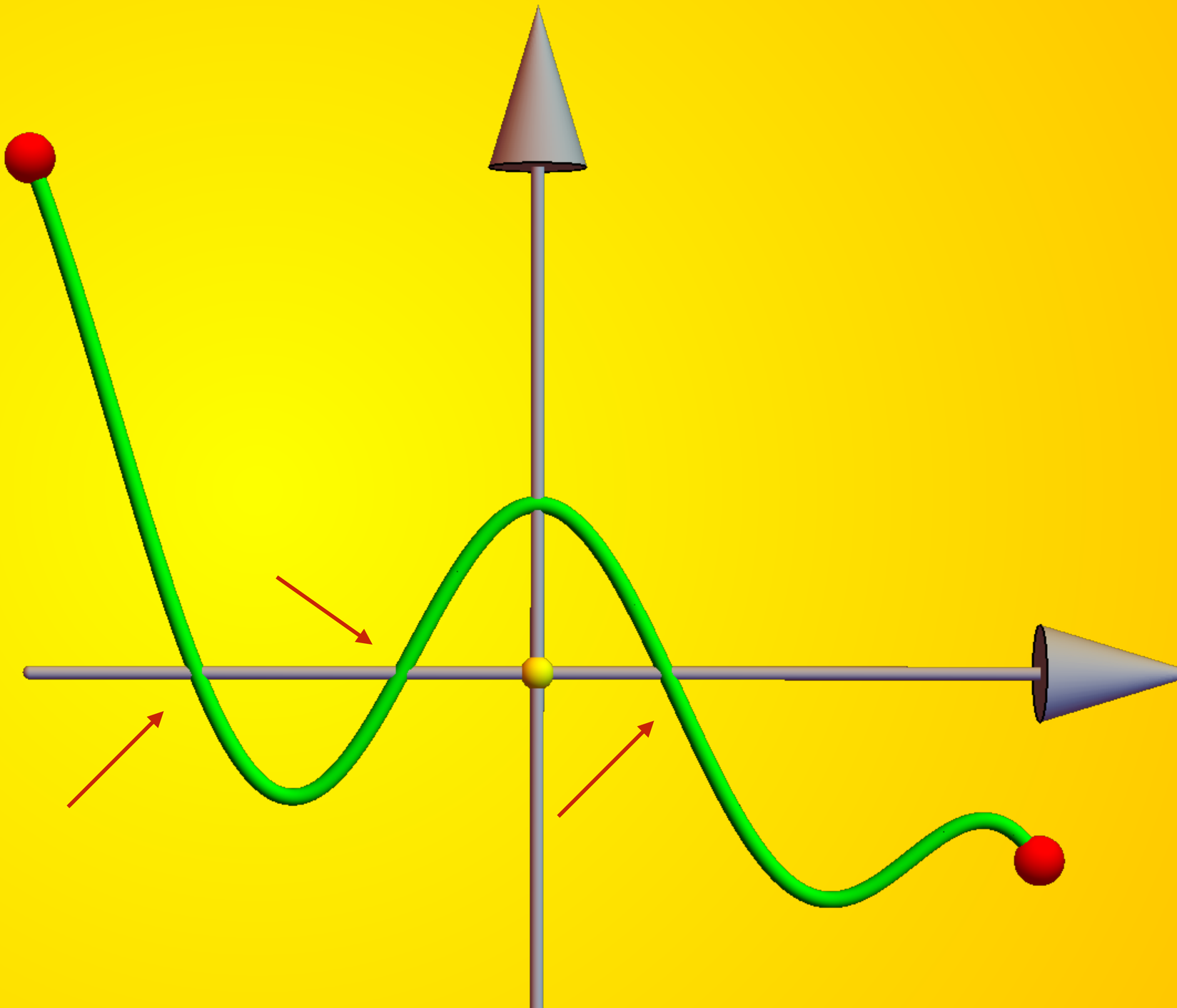


A



B

Roots



Find the Roots:

$\log|x|$

$x^2 - 25$

$\log(\sin^2(x))$

$\exp(3x) - 1$

$\tan(x^2 - 1)$

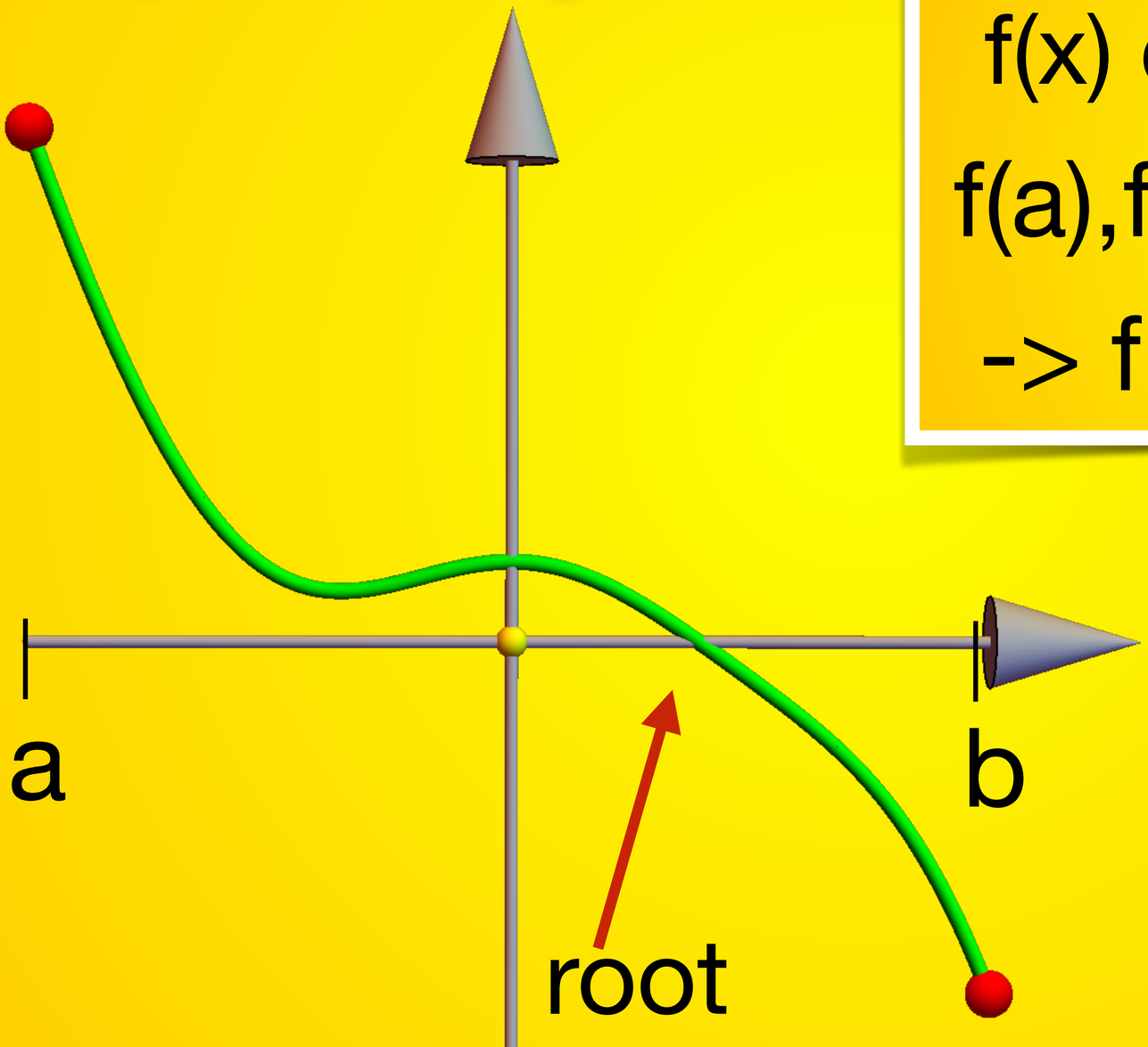
$|x - |x - 2||$

Theorem

f(x) continuous on [a,b]

f(a),f(b) different signs

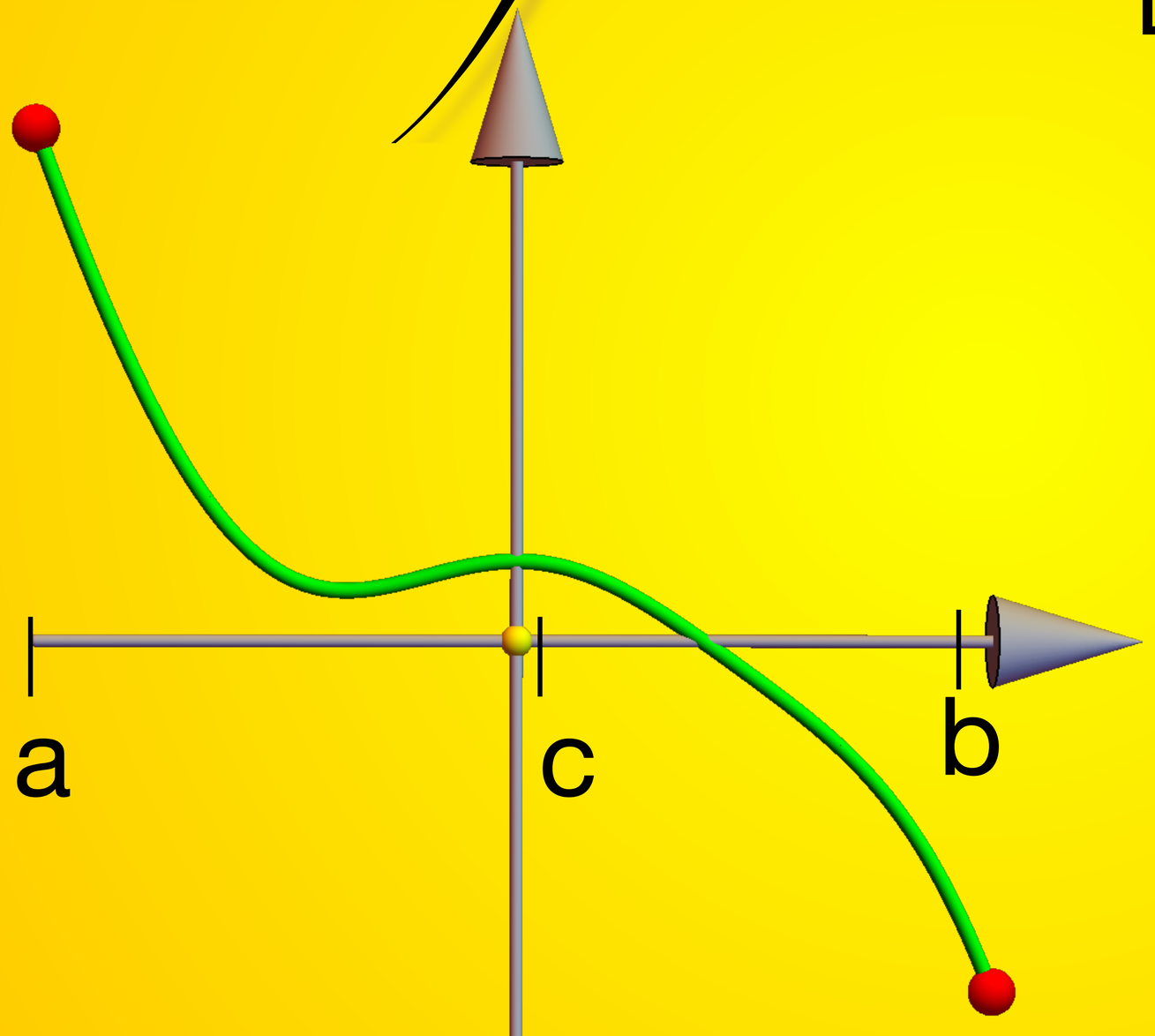
-> f has a root in [a,b]



Why

Proof: to get to the other side, you have to cross the road!

Proof



Divide and conquer

Define c=(a+b)/2

If f(c) f(b)<0, take new interval [c,b]

Otherwise, take interval [a,c].

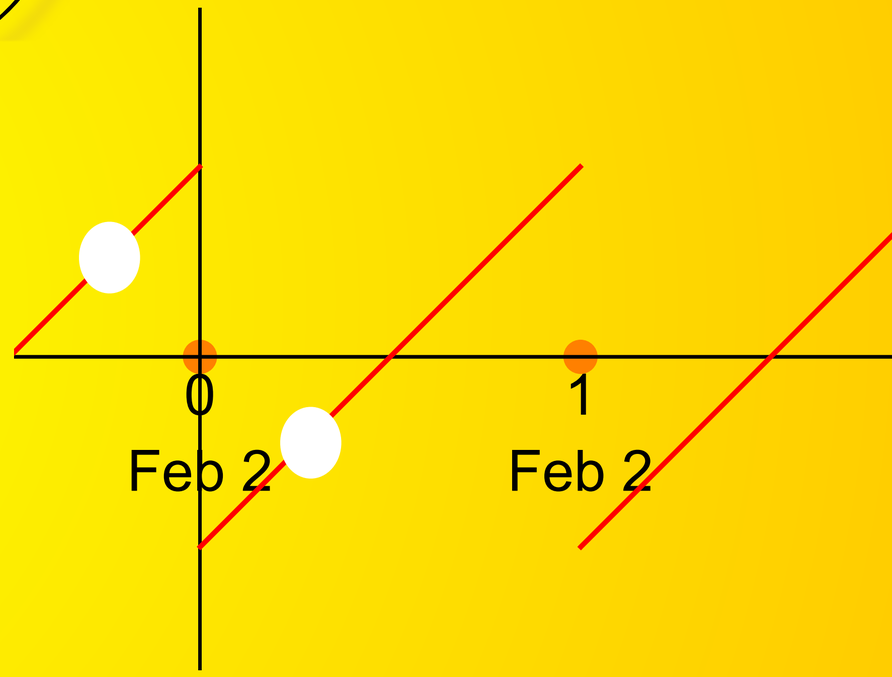
Continue to narrow down.

Ground Hog

The function

$$f(x) = x - \text{floor}(x)$$

is the ground hog function.



f(-0.5) and f(0.5) have different signs. Why is there no root?

Ground Hog

yesterday

Solving equations

Prove that

$$f(x) = \sin(x) + x^3 - |x|$$

have a root.

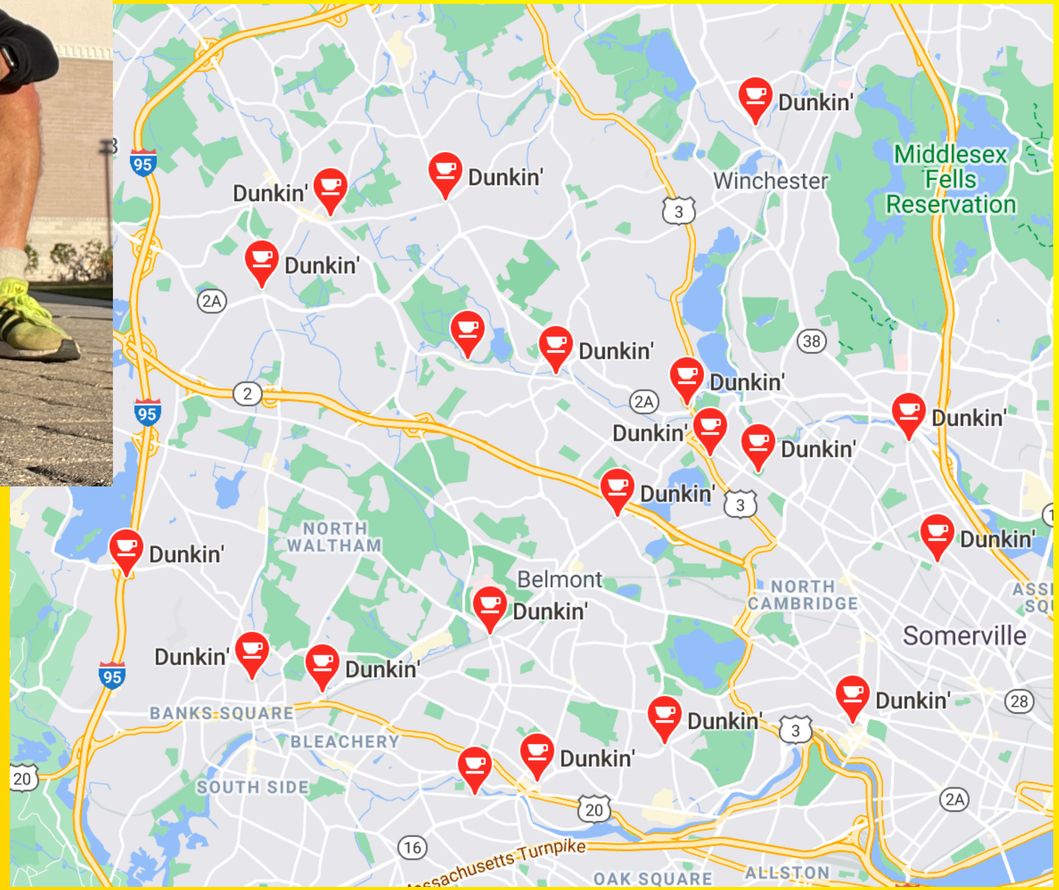
Archilles and Tortoise

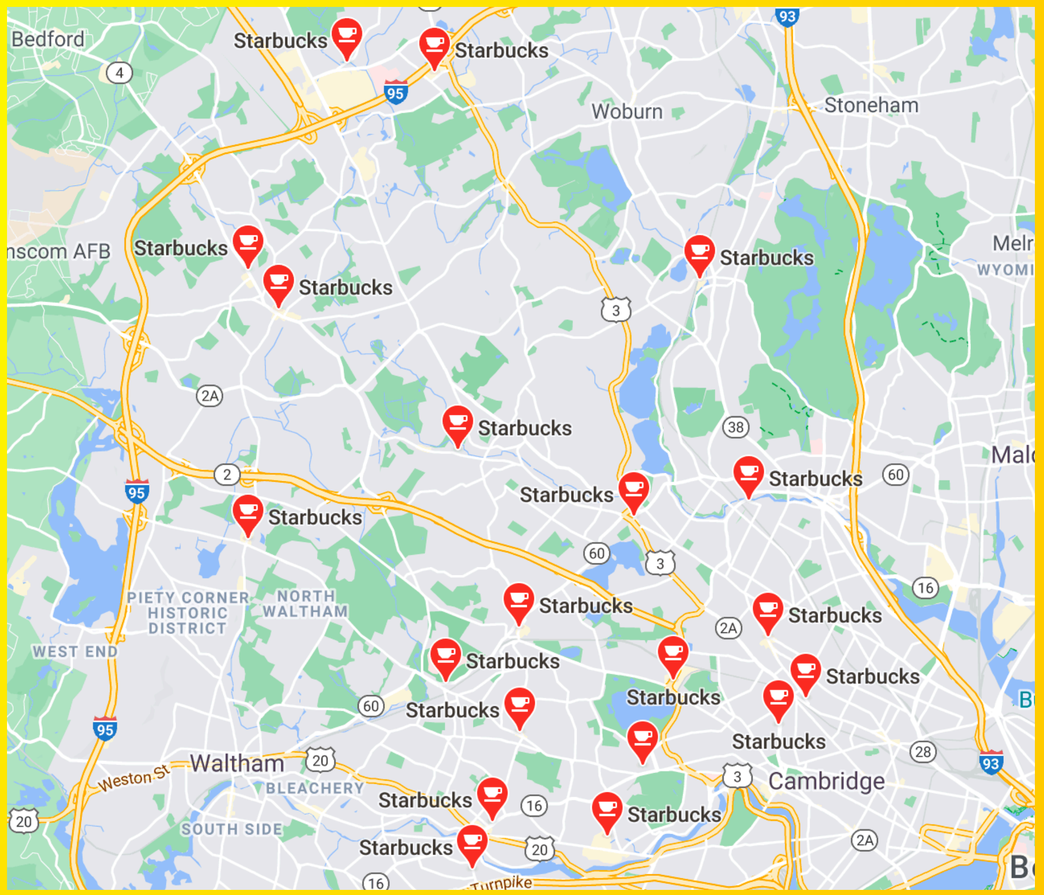
2020
summer

These days. . .

Running forth and back from

Dunkin Doughnuts ⟷ to Starbucks





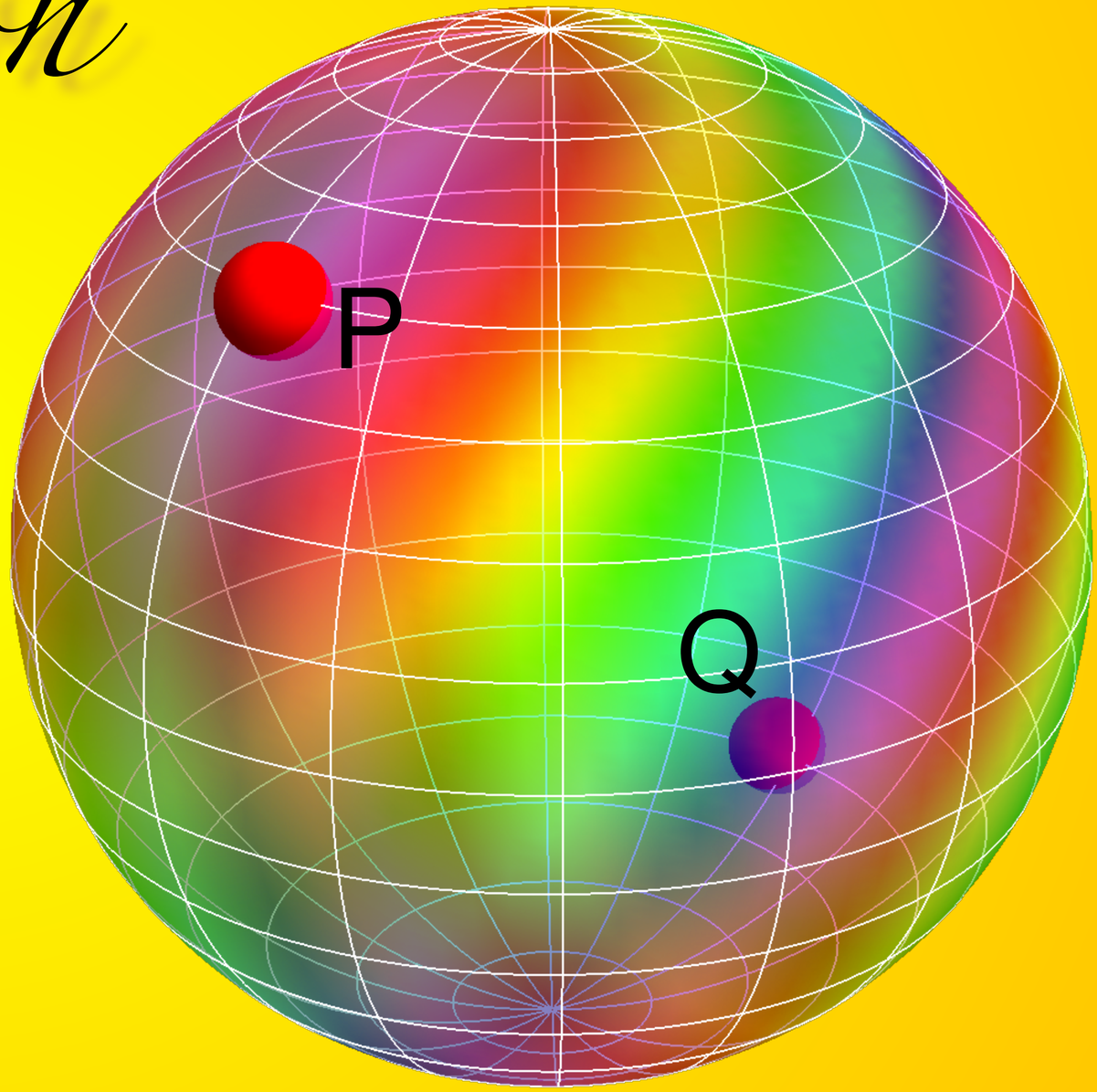
2021

winter

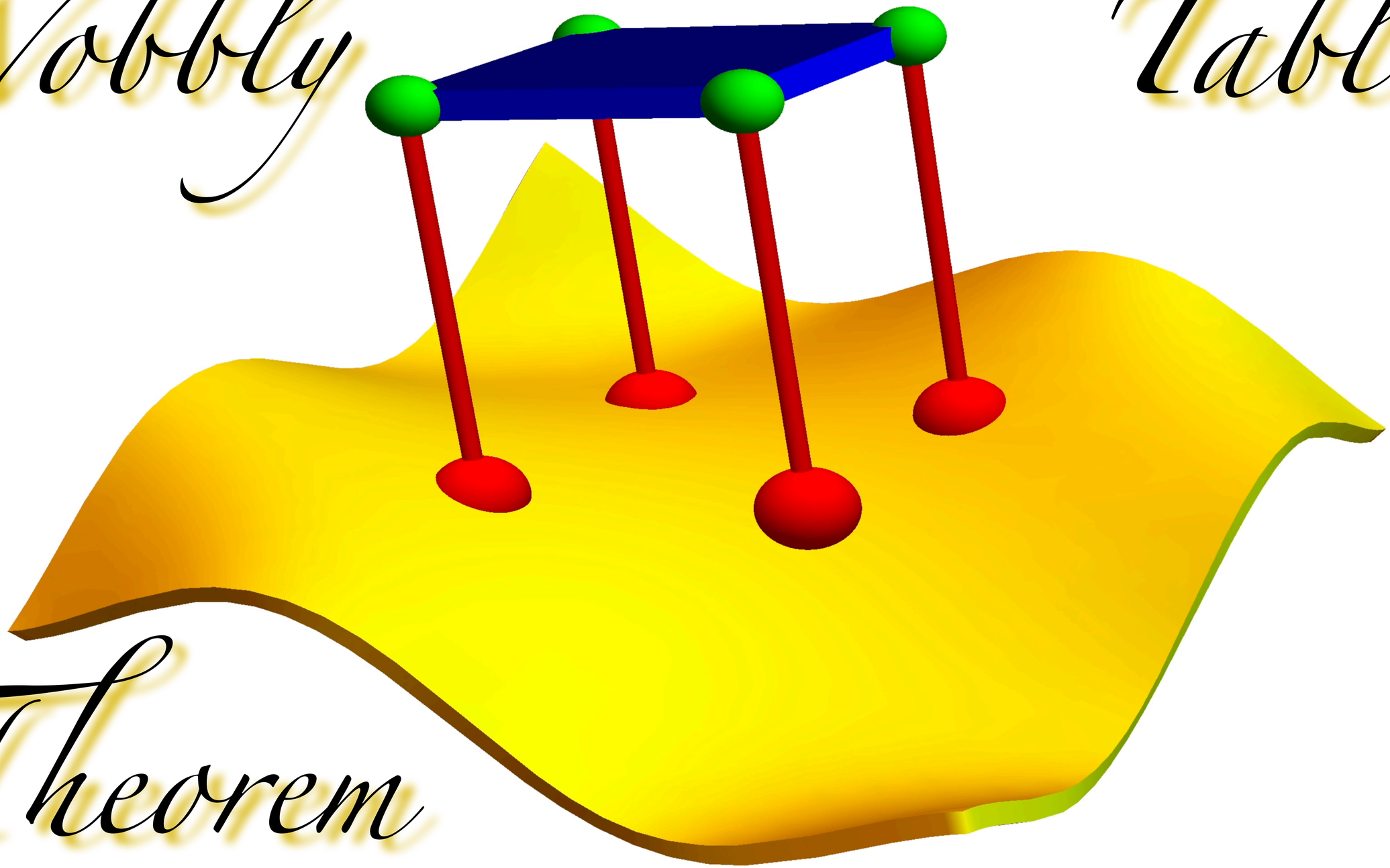
Archilles and Tortoise

Application

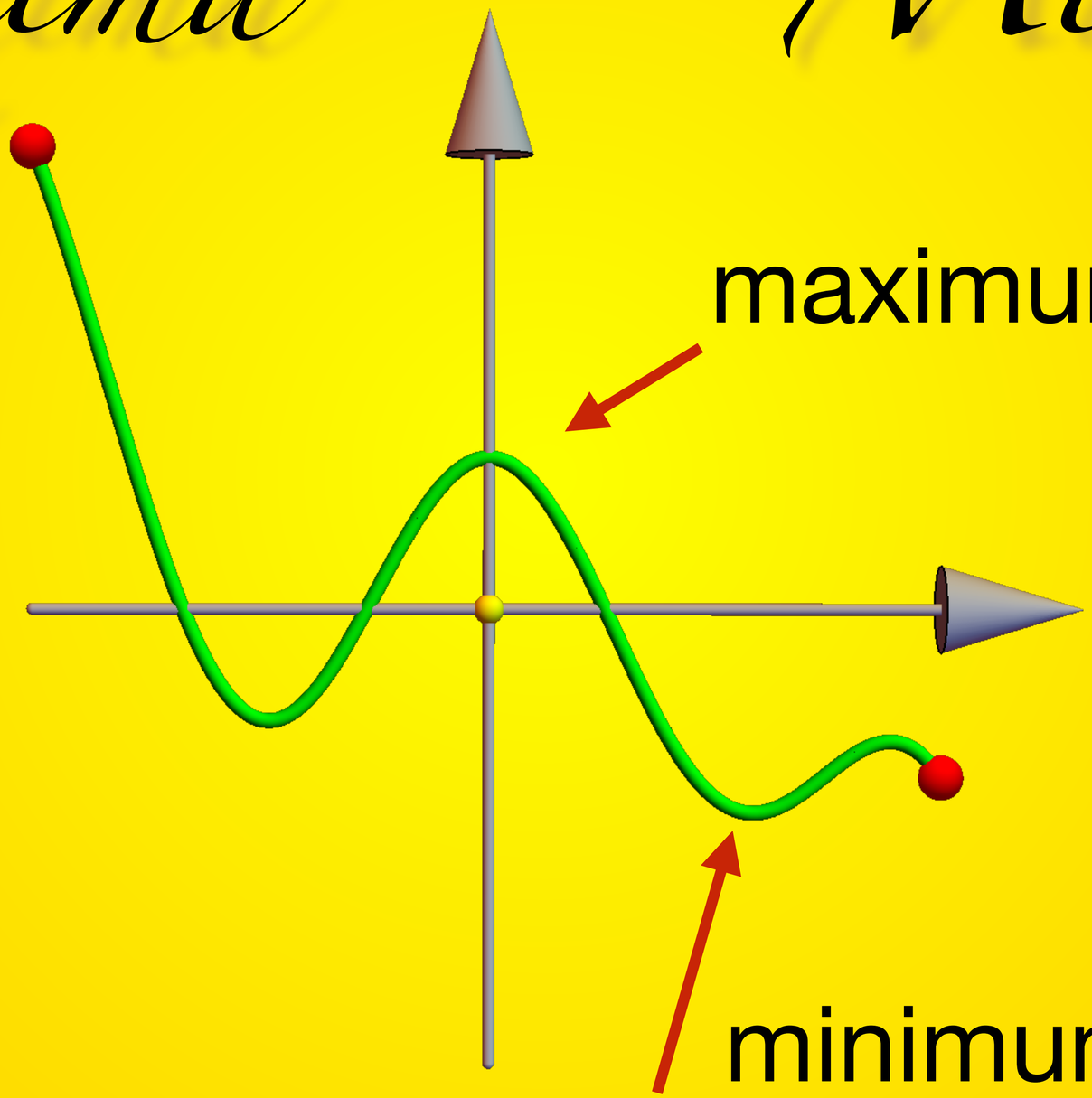
There is a point on earth where the temperature and pressure are the same as on the antipode



Wobbly Table Theorem

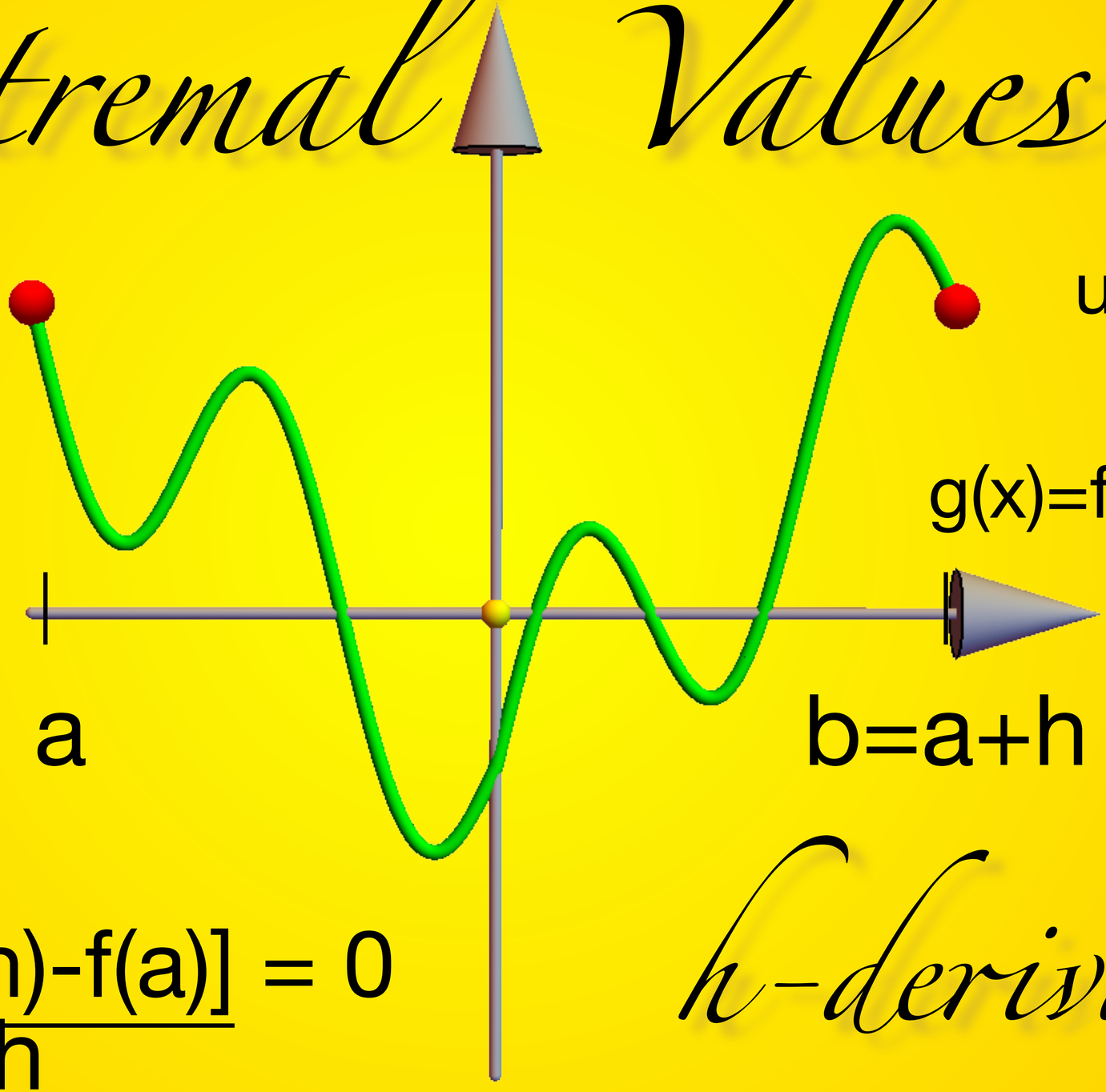


Maxima *Minima*



Extremal Values

Df(a)=0
gives
max or min
in interior



use IVT
for
g(x)=f(x+h/2)-f(x)

$$Df=\frac{[f(a+h)-f(a)]}{h}=0$$

h-derivative

Growth

cm

178

170

was there a time
when they had
the same height?

Thomas

Anja

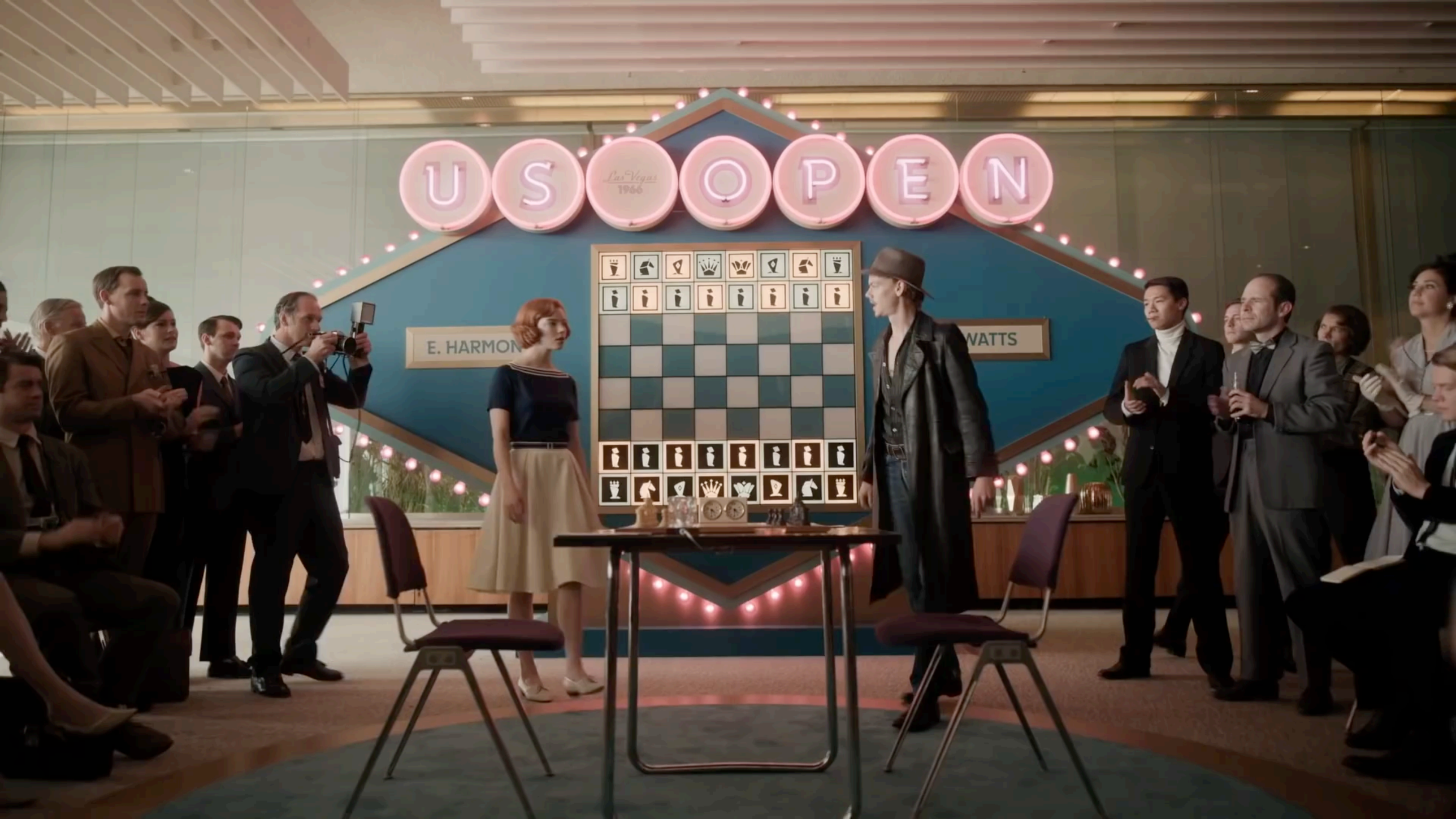
See Homework

1990

1996

2021


NETFLIX
BETH & BENNY


U S OPEN
Las Vegas
1986
E. HARMON
WATTS

JAM

Does the following equation have a solution?

$$x^{11} - \sin(x) = x^5 + |x| + \cos(x)$$

Argue why there was a time in your life when your height was 1000 times the length of your teeth.

The End