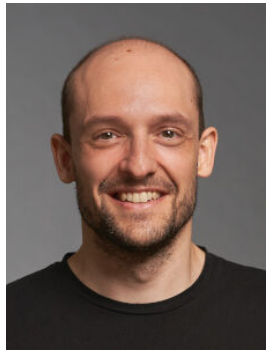
Computational Geometry

Exercise

Jean-Pierre, Marcus, Wendy

Introductions



Thomas

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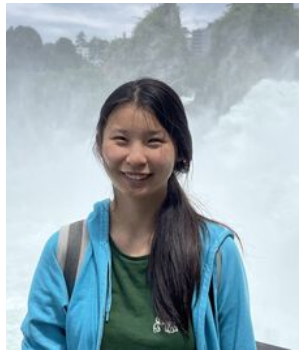

Wendy

Lecture

Exercise

About you?

- name
- favourite lecture so far

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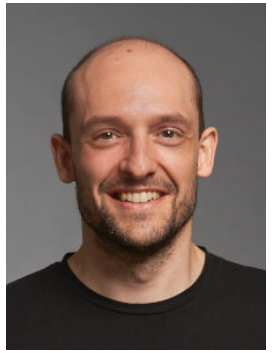

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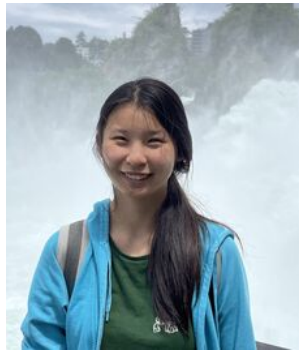

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About the Exercise

Exercise Sheets

- new sheet every two weeks

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Exercise Session

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Problem: boring

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Plan for today

- vocabulary
- (more) general remarks
- work on sheet 1
- additional problem

Vocabulary

- point

Vocabulary

- point

Vocabulary

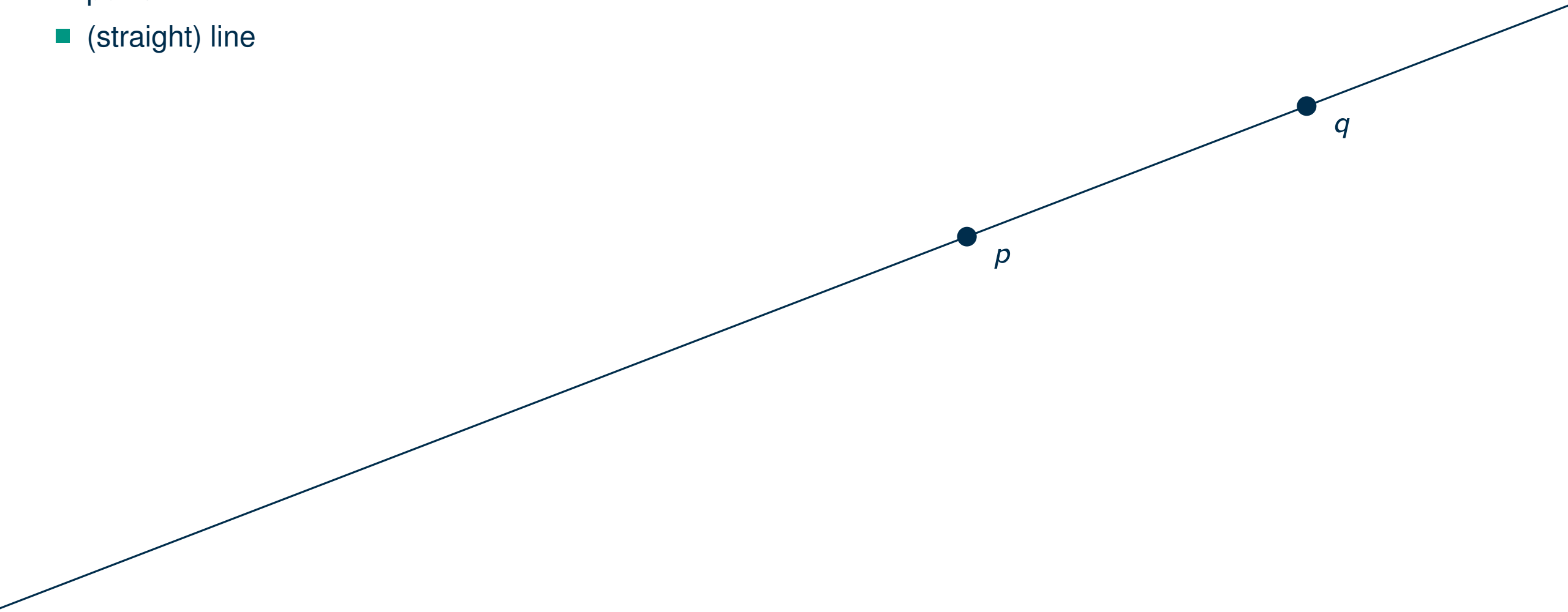
- point

Vocabulary

- point

Vocabulary

- point
- (straight) line



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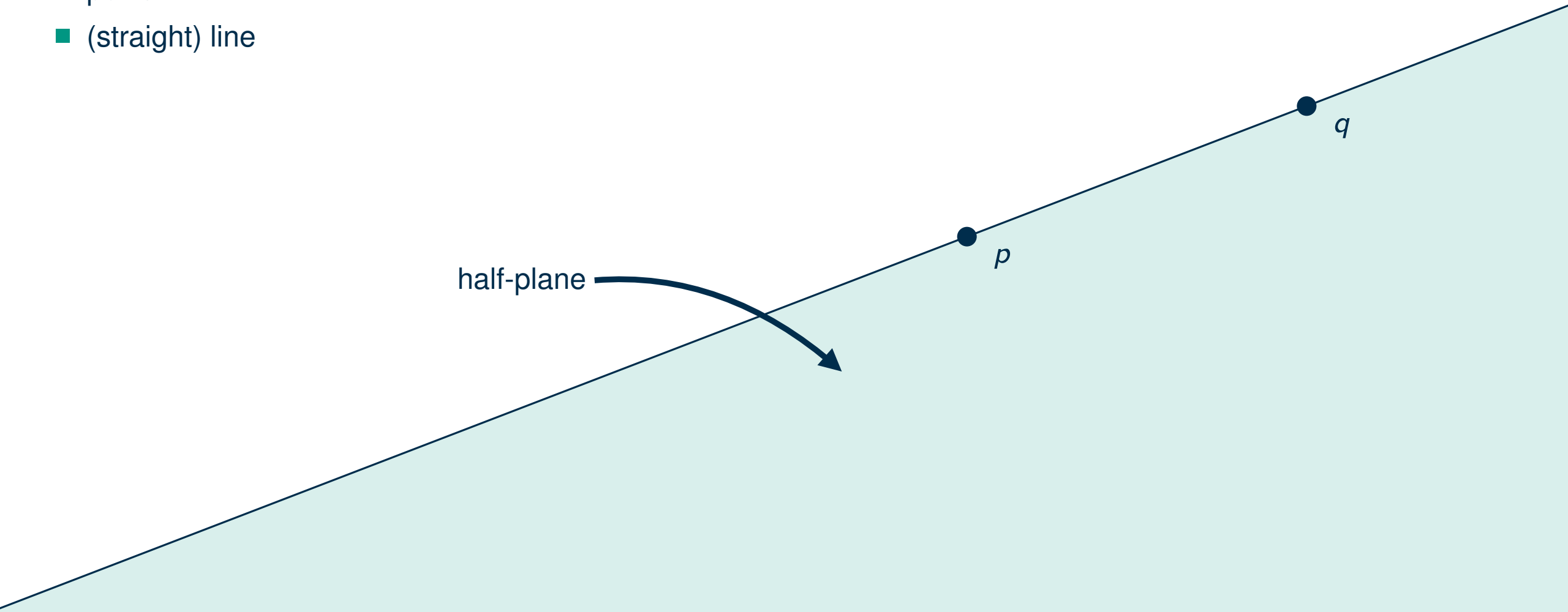

Vocabulary

- point
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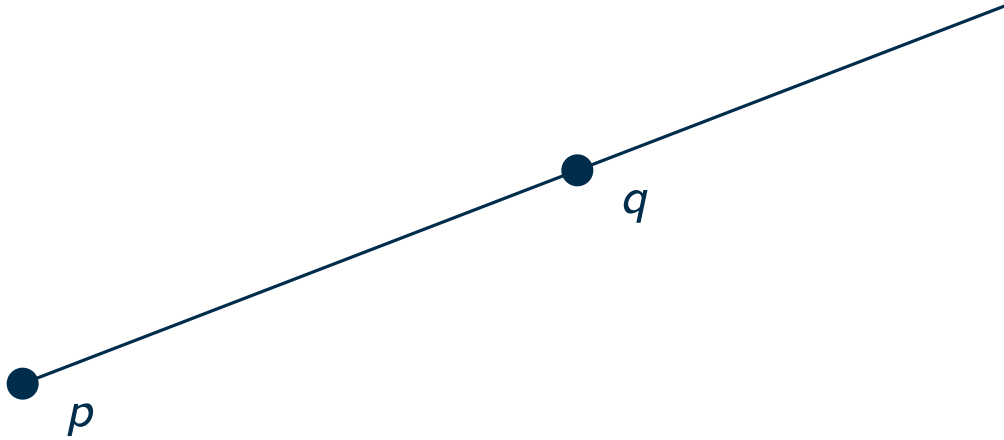
Vocabulary

- point
- (straight) line
- ray



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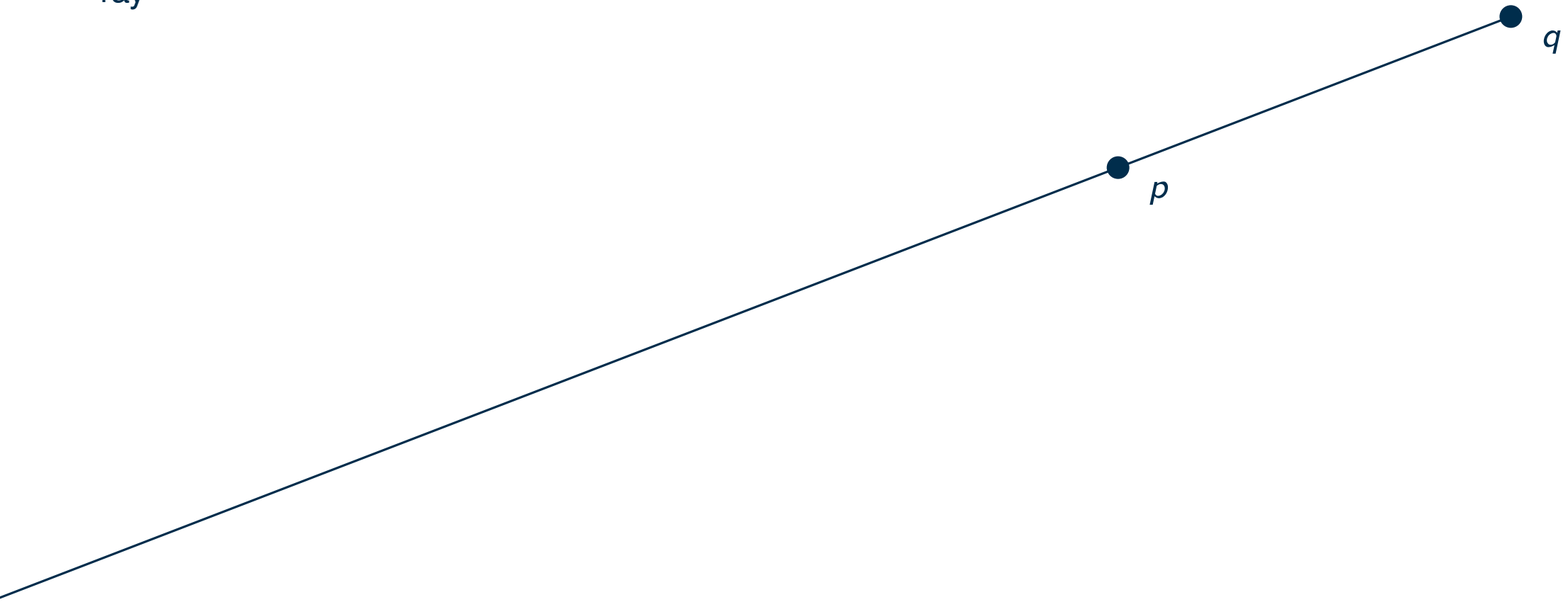
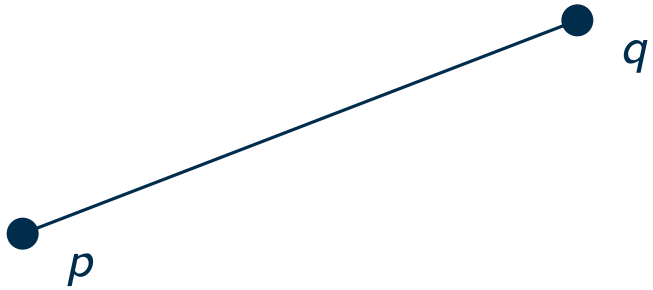


Vocabulary

- point
- (straight) line
- ray
- line segment



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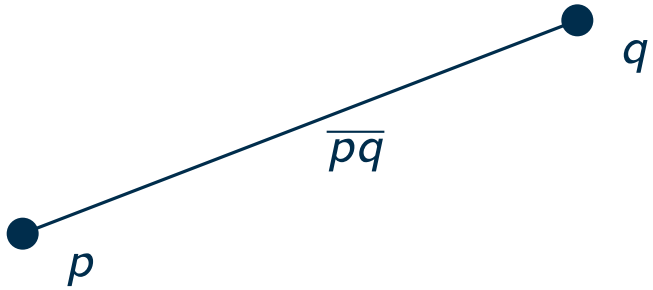
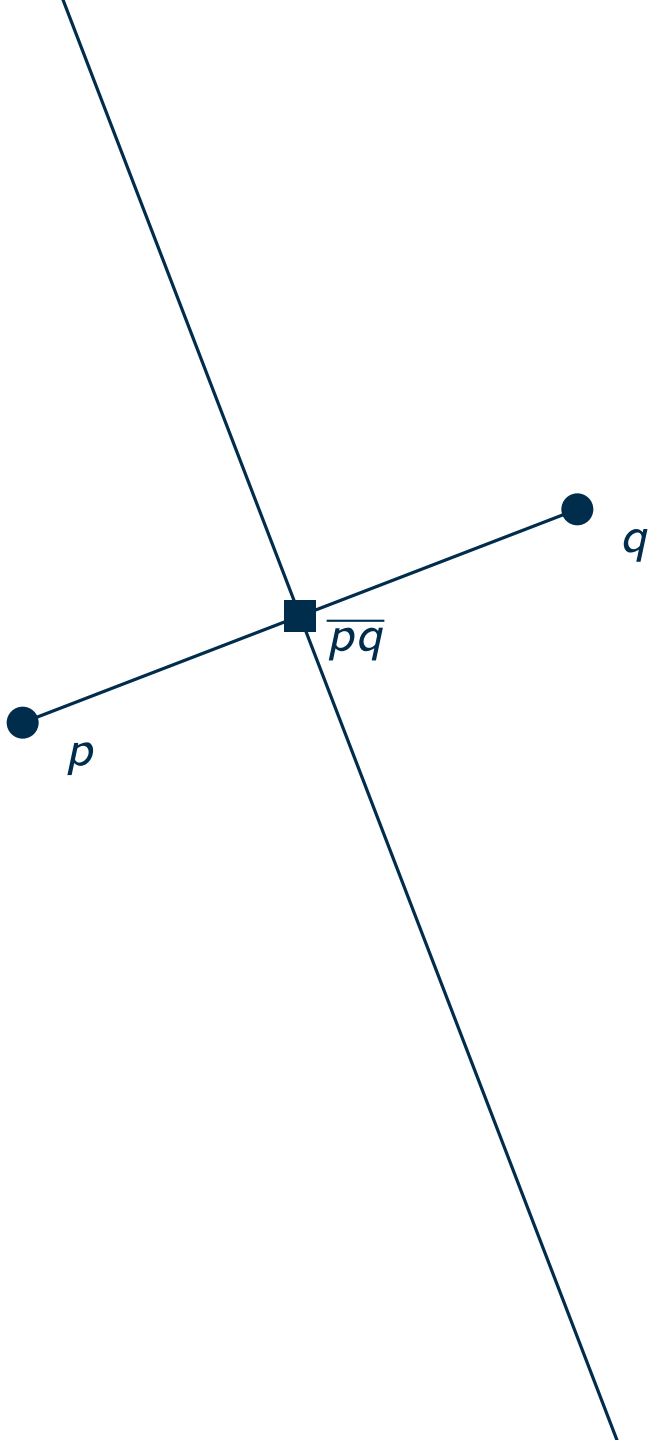


Vocabulary

- point
- (straight) line
- ray
- line segment
- bisector
  - perpendicular



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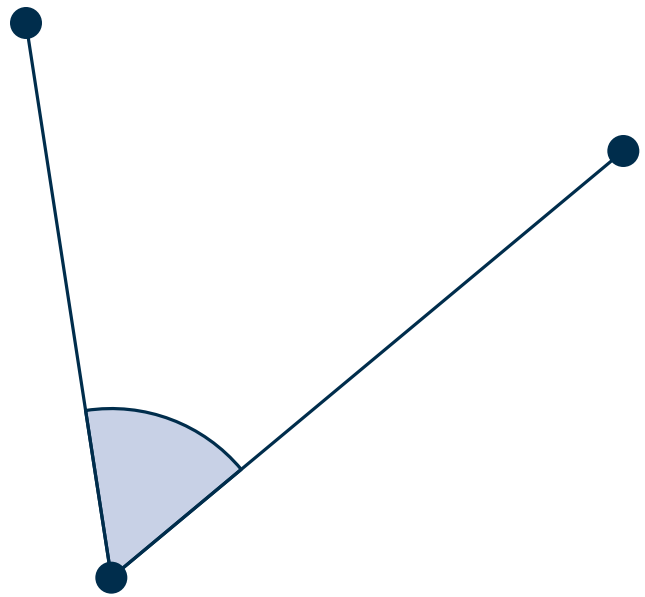
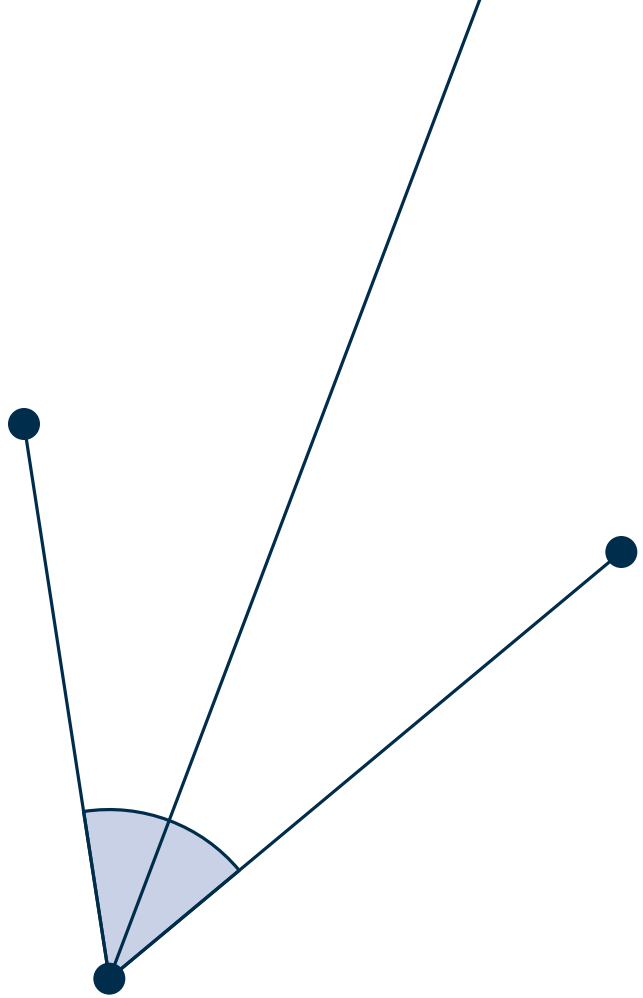


Vocabulary

- point
- (straight) line
- ray
- line segment
- bisector
  - perpendicular
  - angular



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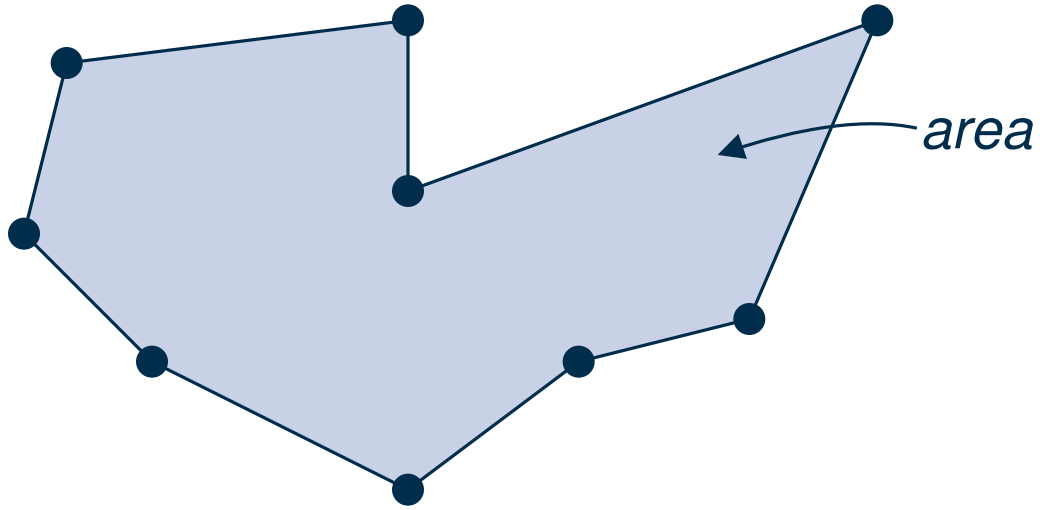
  - angular
- polygon



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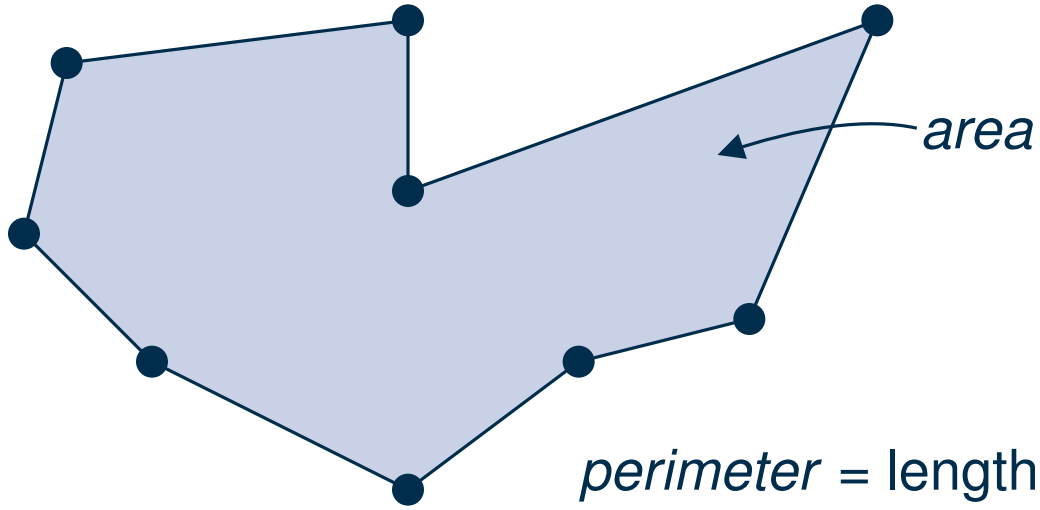

perimeter = length of boundary

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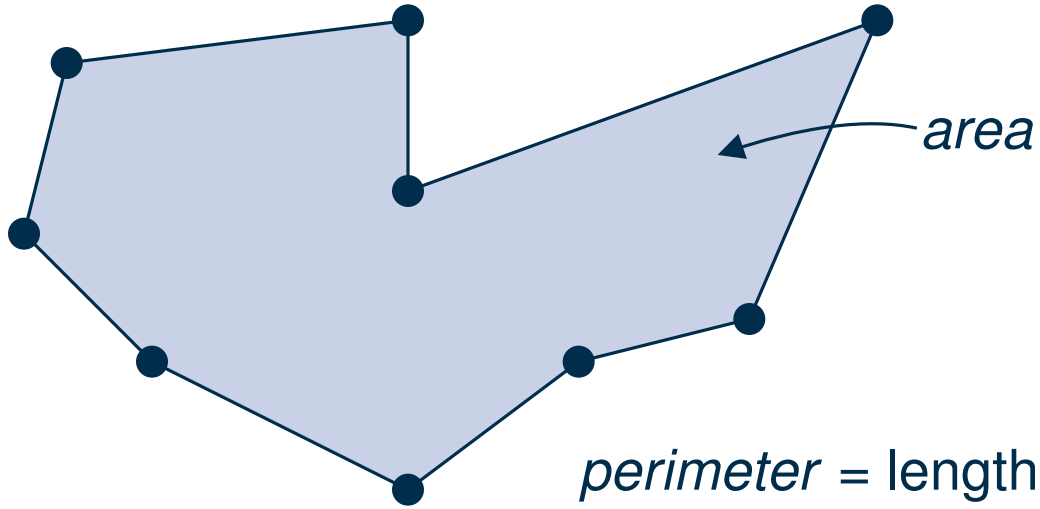

perimeter = length of boundary

circumference = perimeter of circle

Vocabulary

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- ray
- line segment
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  - perpendicular
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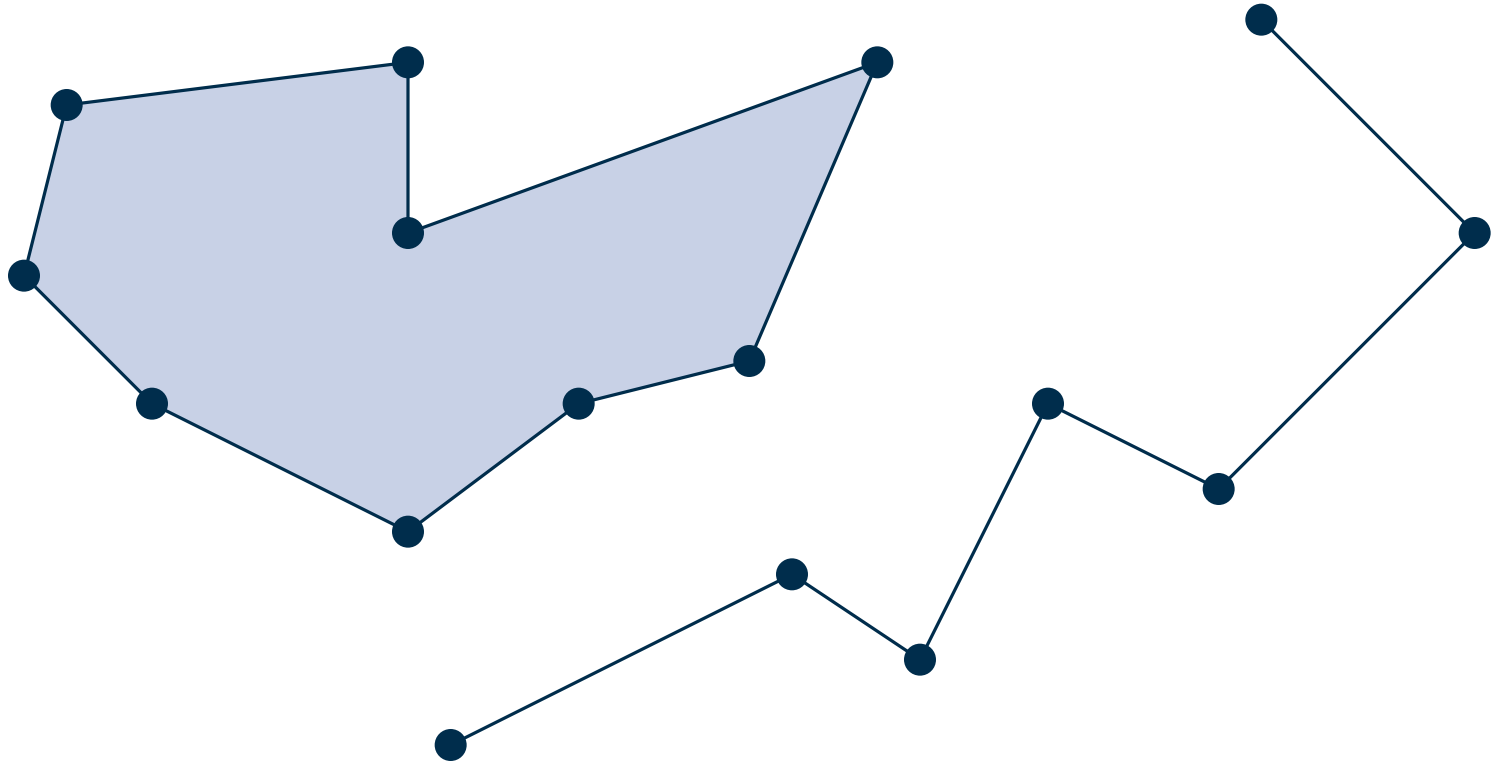
- polygon
- polygonal chain / poly-line



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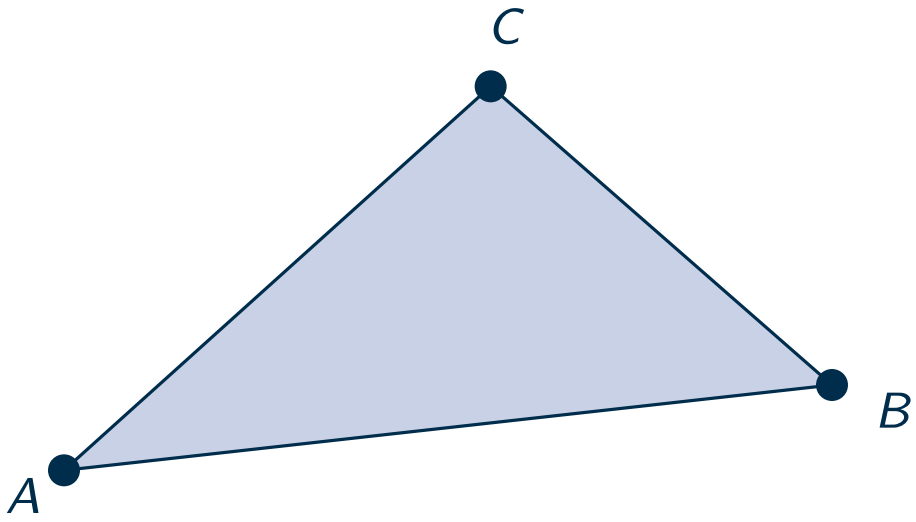

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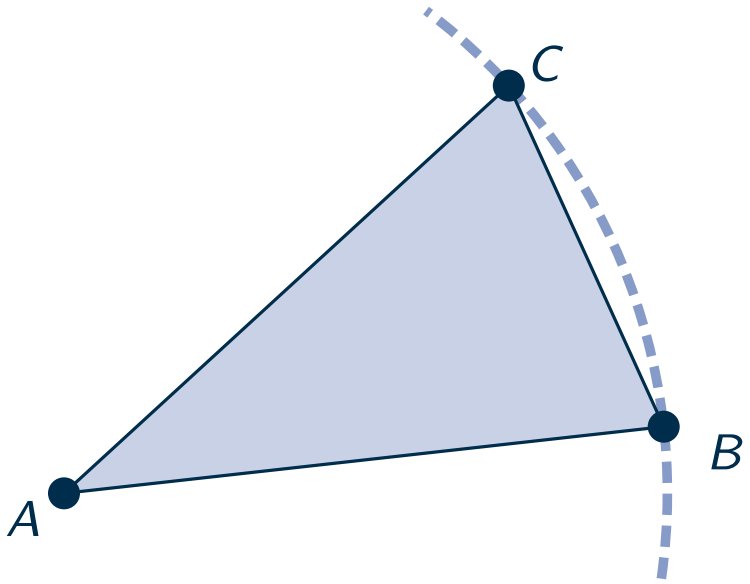
  - isosceles



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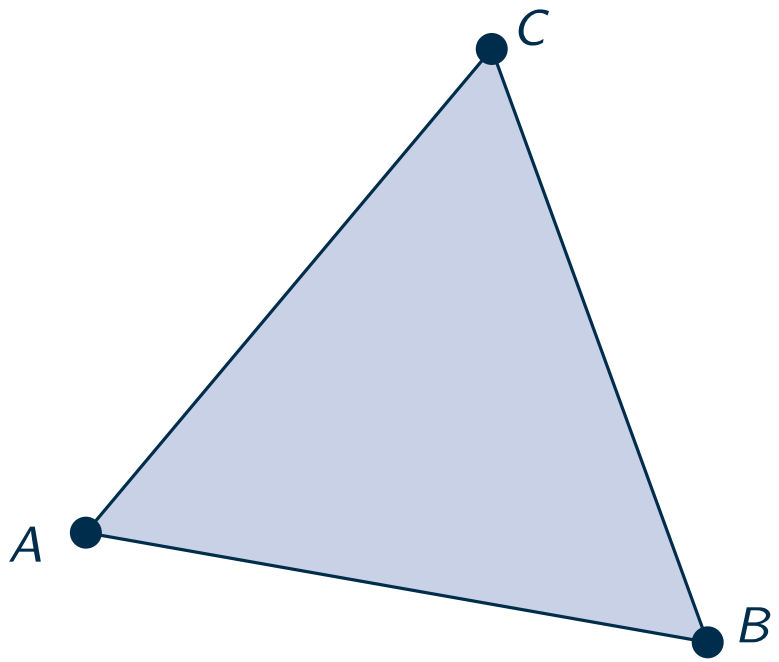

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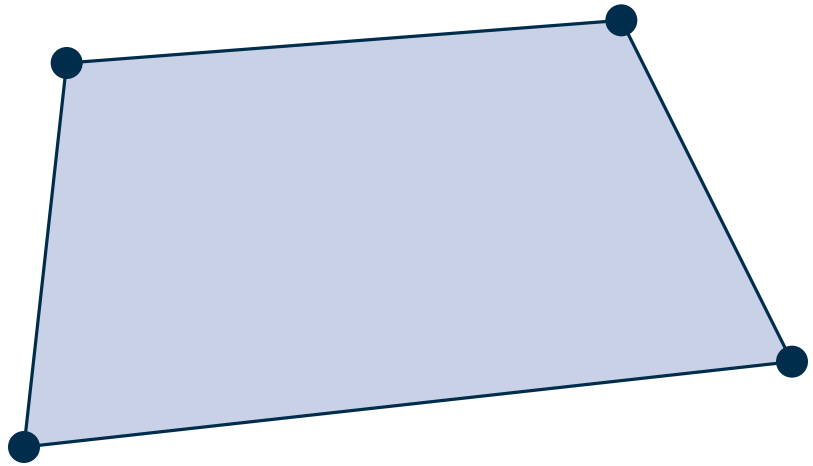

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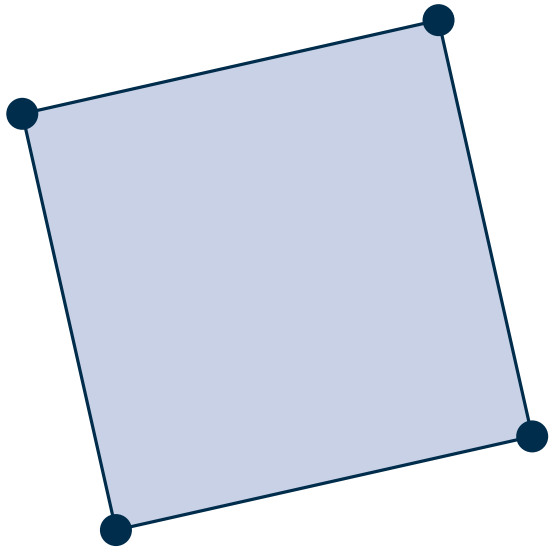

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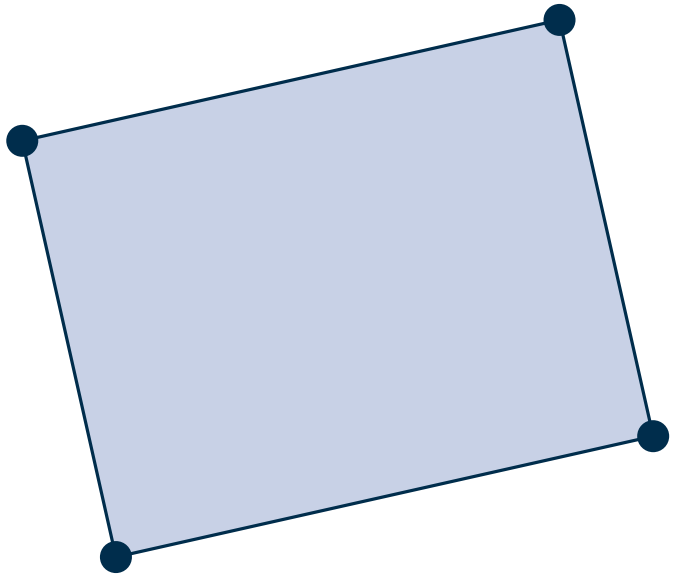

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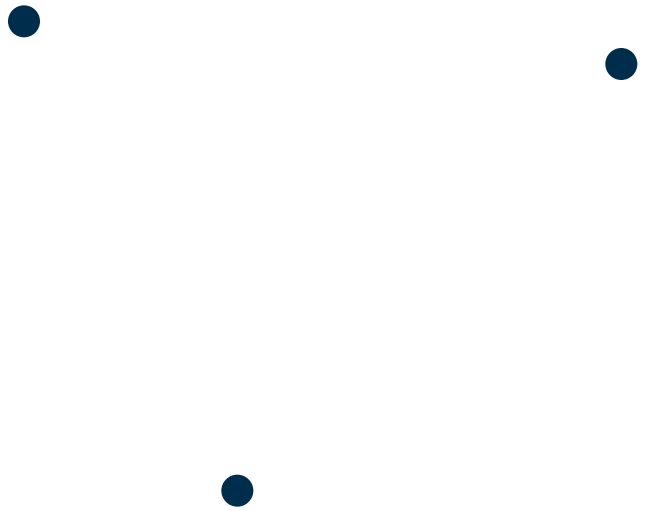

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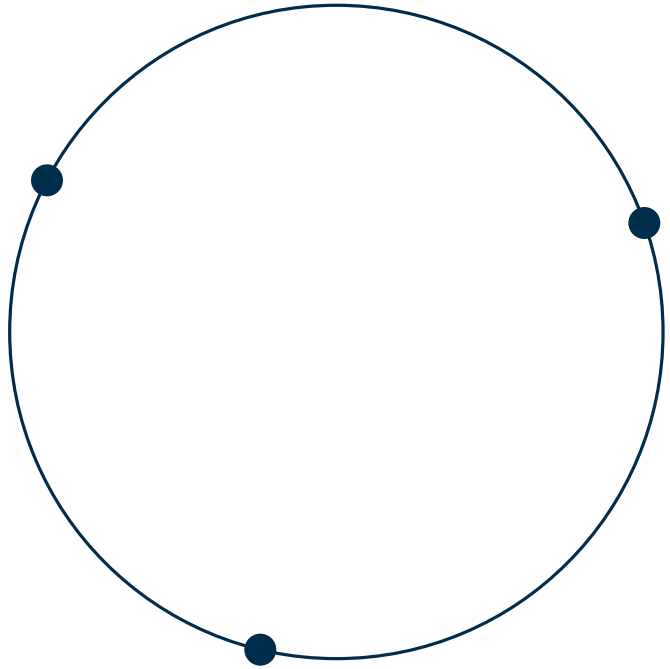

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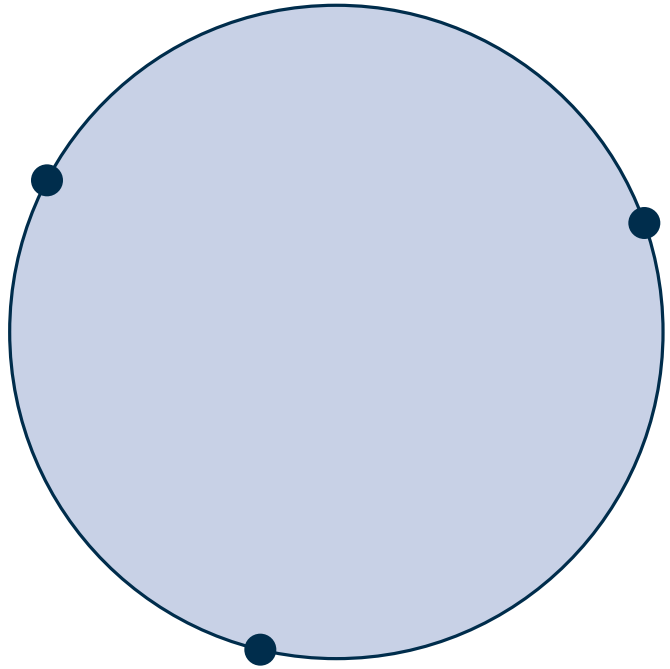

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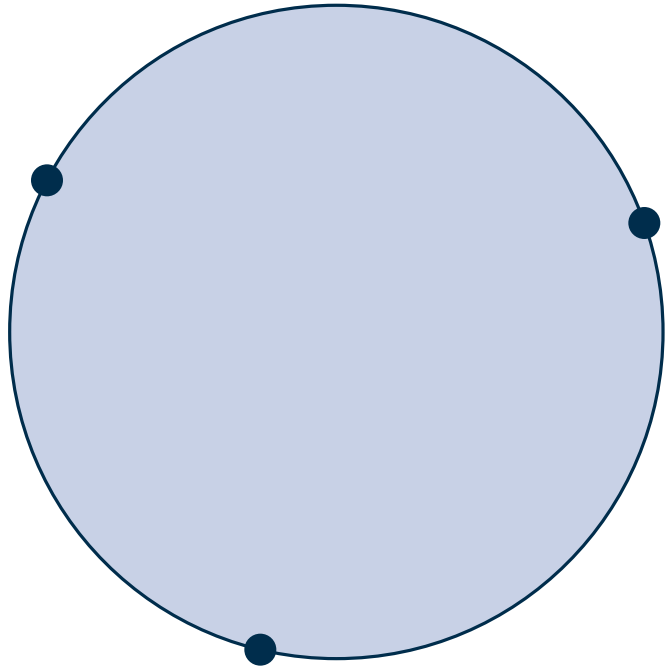

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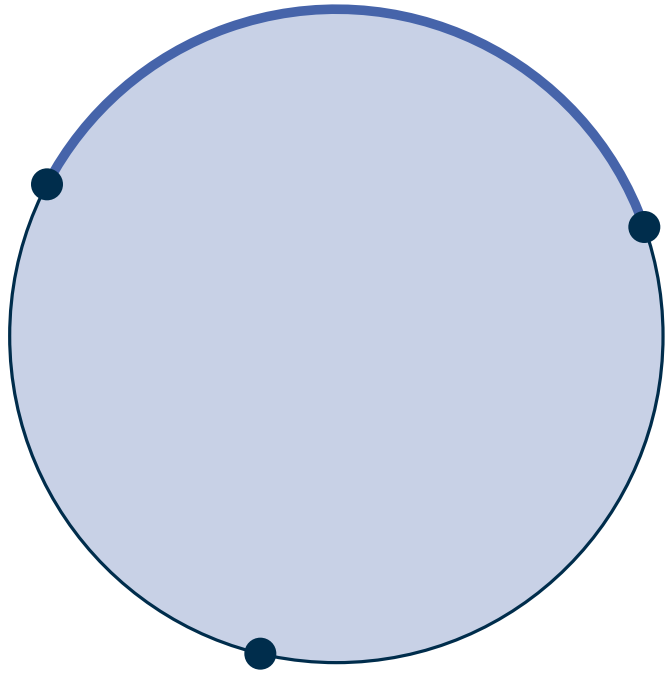
- sphere, ball
- (circular) arc



How to: Assignment Sheet

Describing algorithms

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- show correctness [and argue running time]

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- important: convey (all of) the main idea

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Level of abstraction

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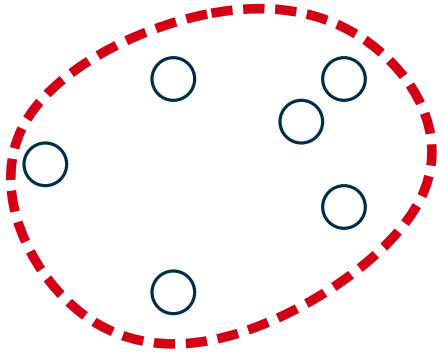
- prefer explanations over mathematical formulas
- abstract away details when it's clear (how) they work
- drawings are (often) helpful

Assignment Sheet 1

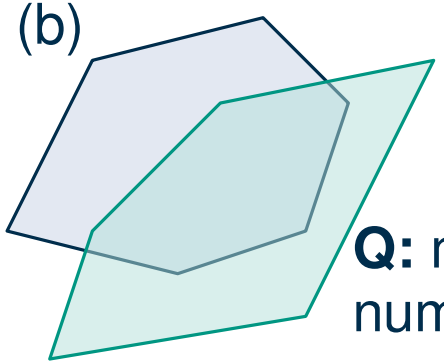
Mysterious Meteorites

(a)



Q: minimize barrier tape

(b)



Q: maximum number of corners?

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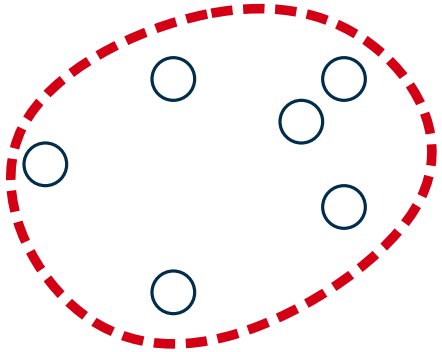

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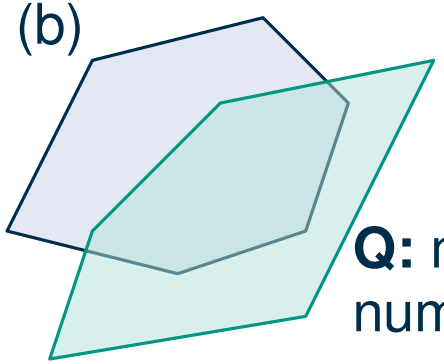
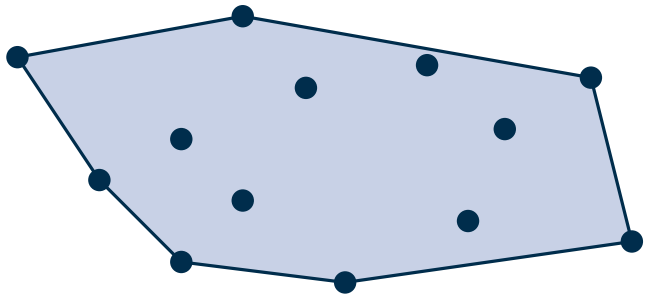


Q: maximum number of corners?

Convex Hull via Divide and Conquer



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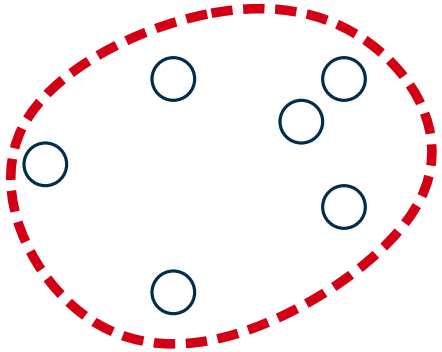

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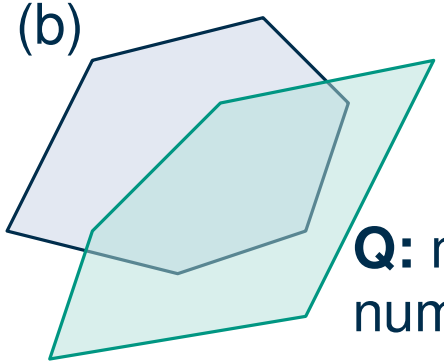
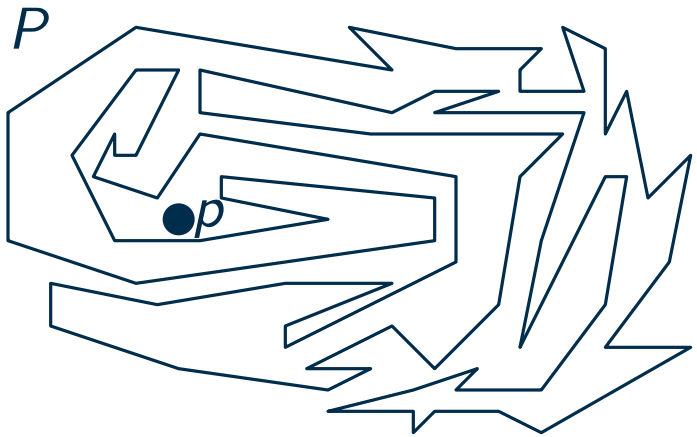
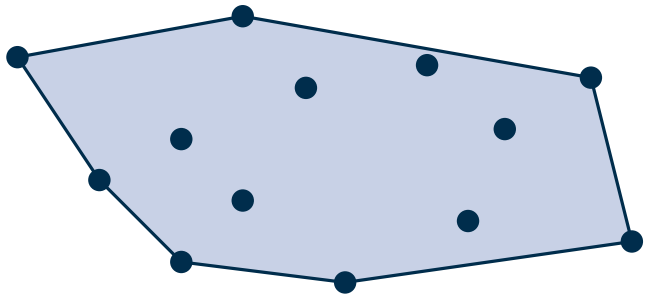


Q: maximum number of corners?

Aerial Photography



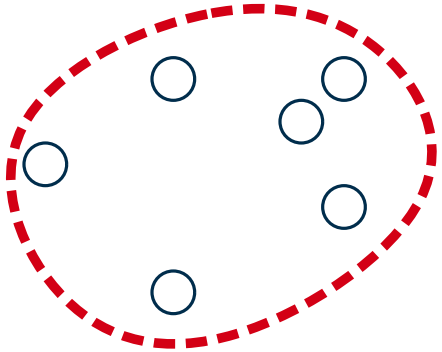
Convex Hull via Divide and Conquer



Assignment Sheet 1

Mysterious Meteorites

(a)



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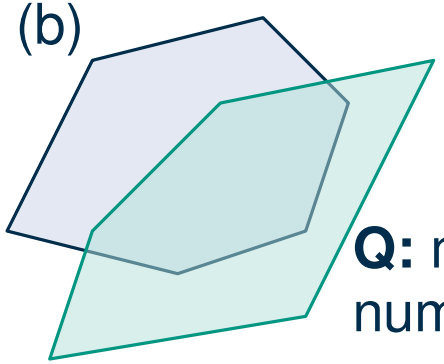

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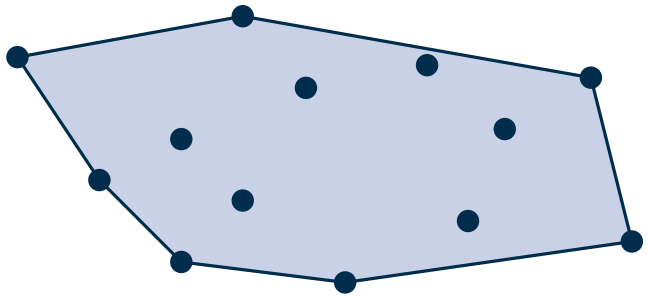

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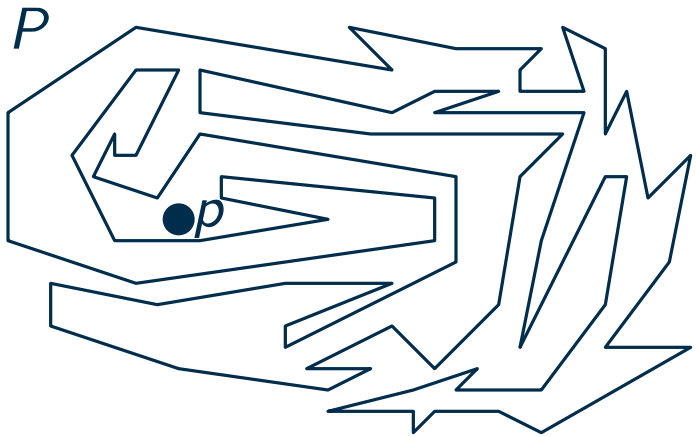

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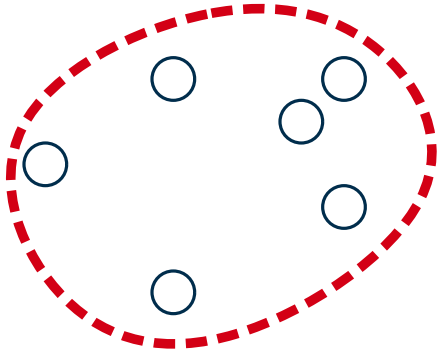

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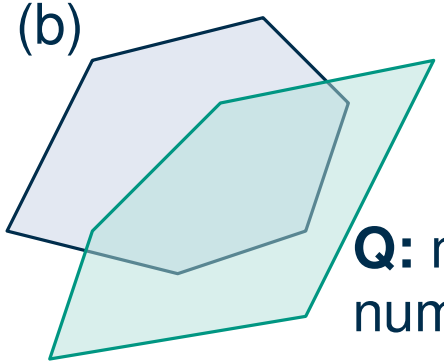

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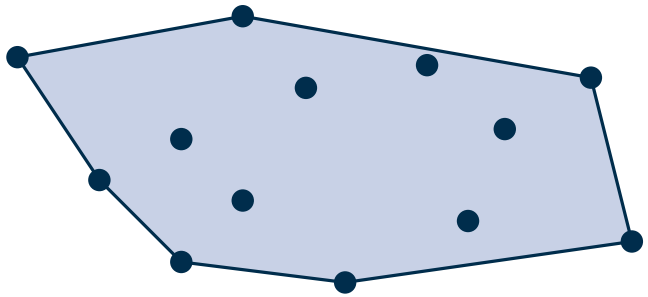

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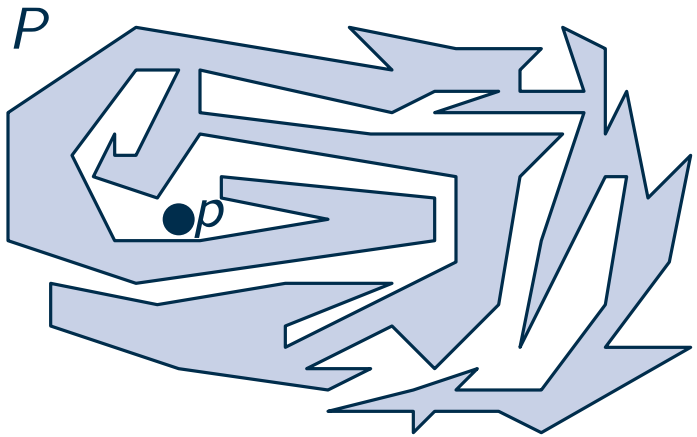

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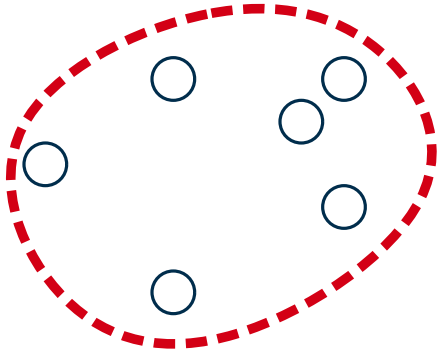

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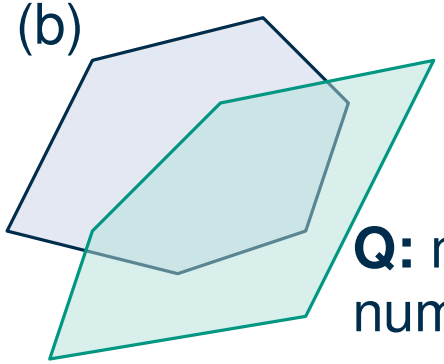

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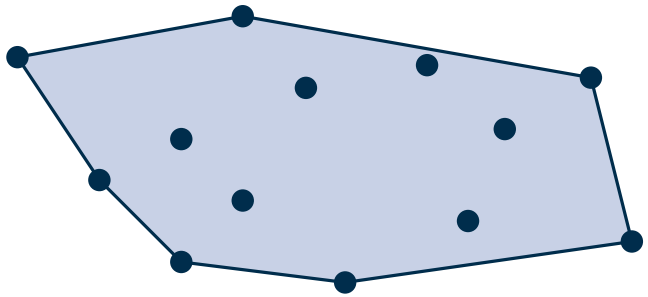

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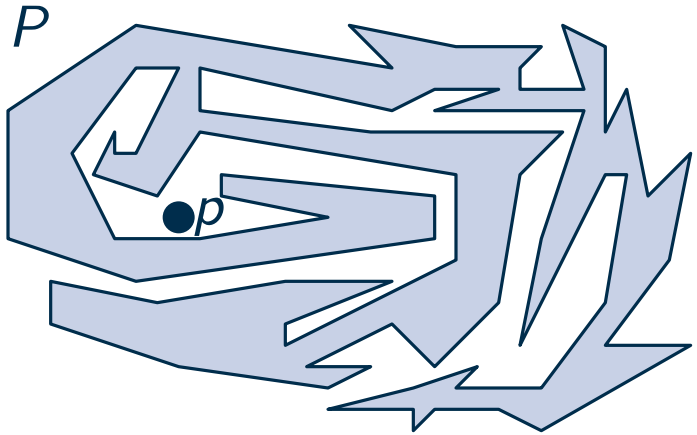

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Map Overlay

Assignment Sheet 1

Mysterious Meteorites

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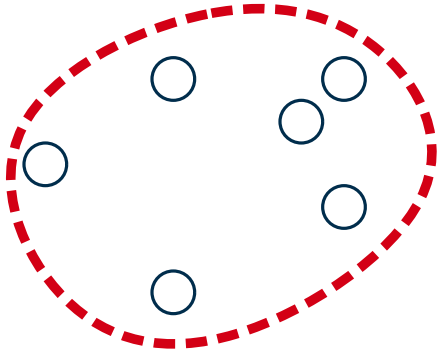

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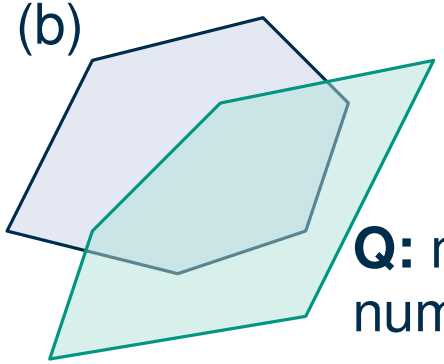

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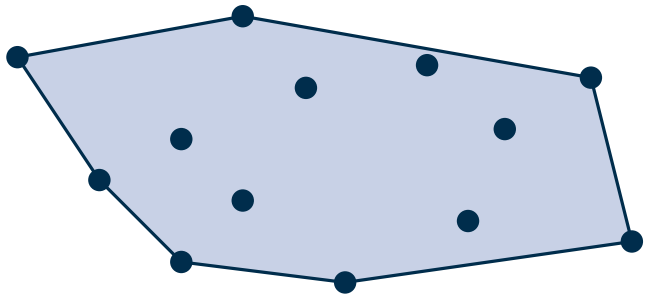

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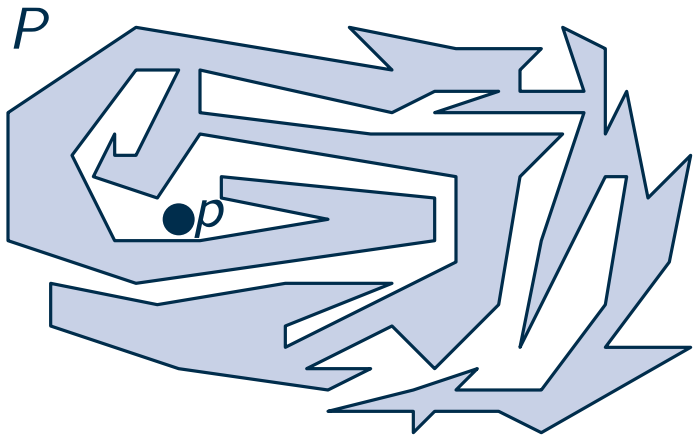

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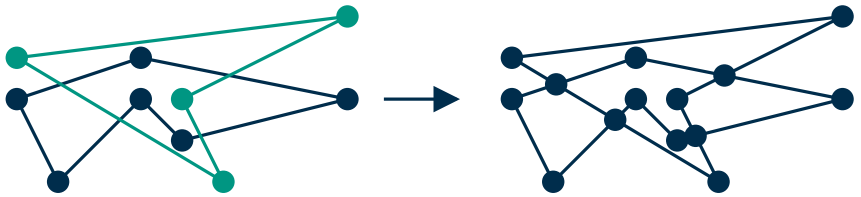

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Mysterious Meteorites

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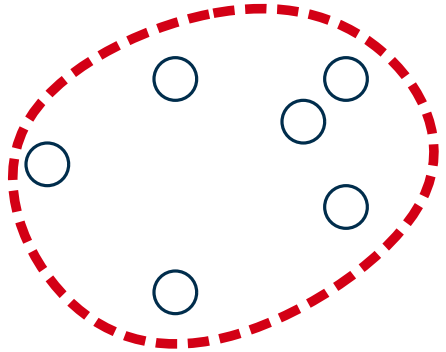

Q: minimize barrier tape

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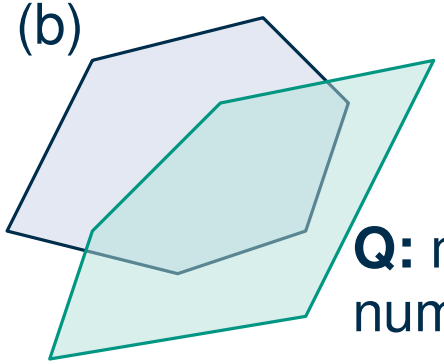

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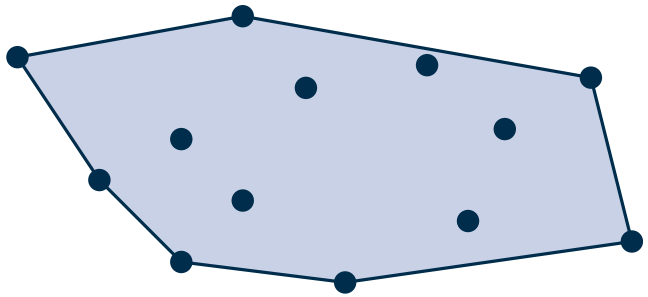

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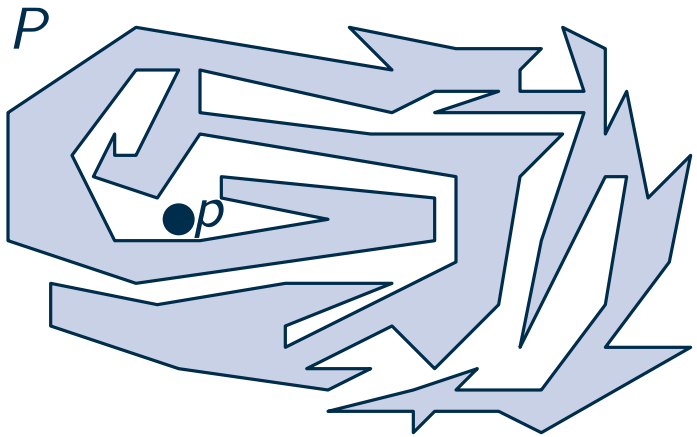
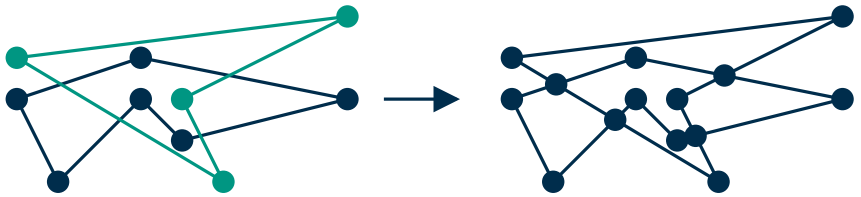


Task: Give algorithm to decide if $p \in P$.

Map Overlay



Boolean Operations

Given: Polygons P, Q

Task: compute $P \cap Q$, $P \cup Q$, and $(P \cup Q) \setminus (P \cap Q)$

Assignment Sheet 1 – Hints

Mysterious Meteorites

(a) (b)

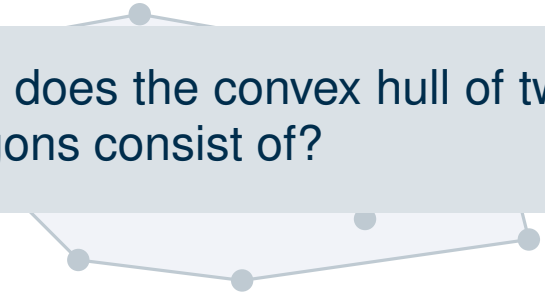
High-level description of algorithm suffices.
Do not explain how to calculate angles, intersections...

Q: maximum number of corners?

Q: minimize barrier tape

Convex Hull via Divide and Conquer

What does the convex hull of two polygons consist of?

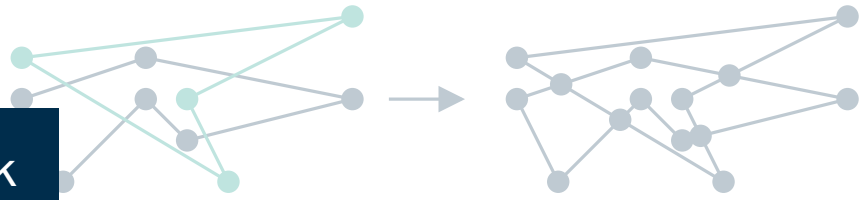


Aerial Photography

Task: Give algorithm to decide

Ask me if you are stuck

Map Overlay



Boolean Operations

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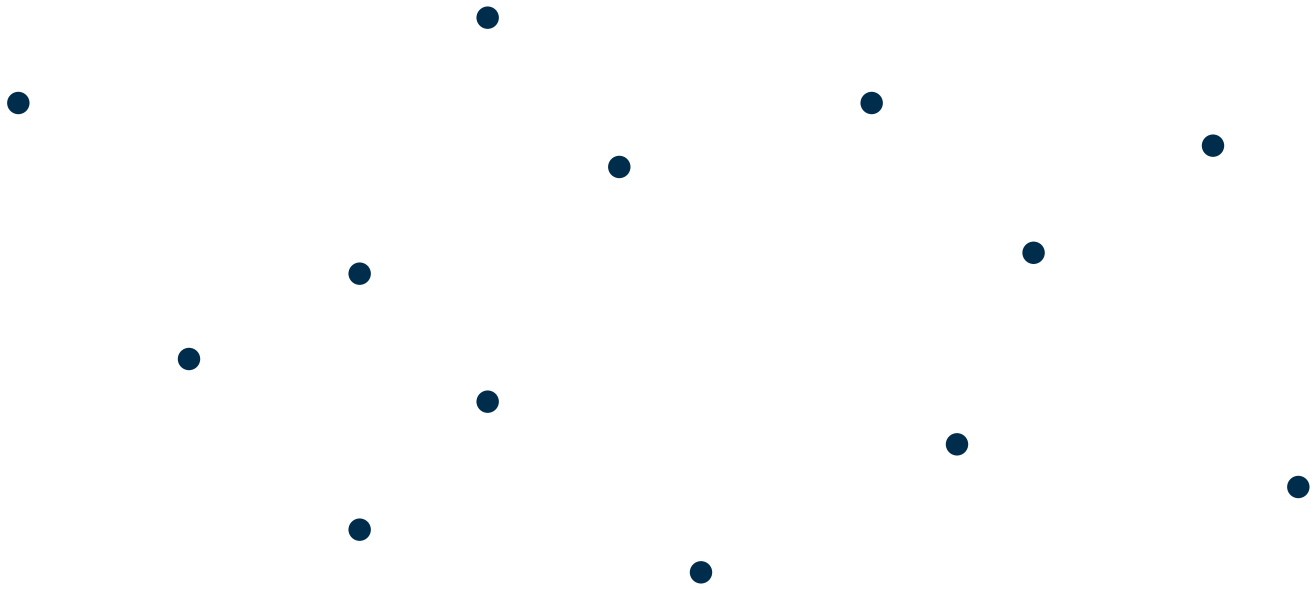
Additional problem

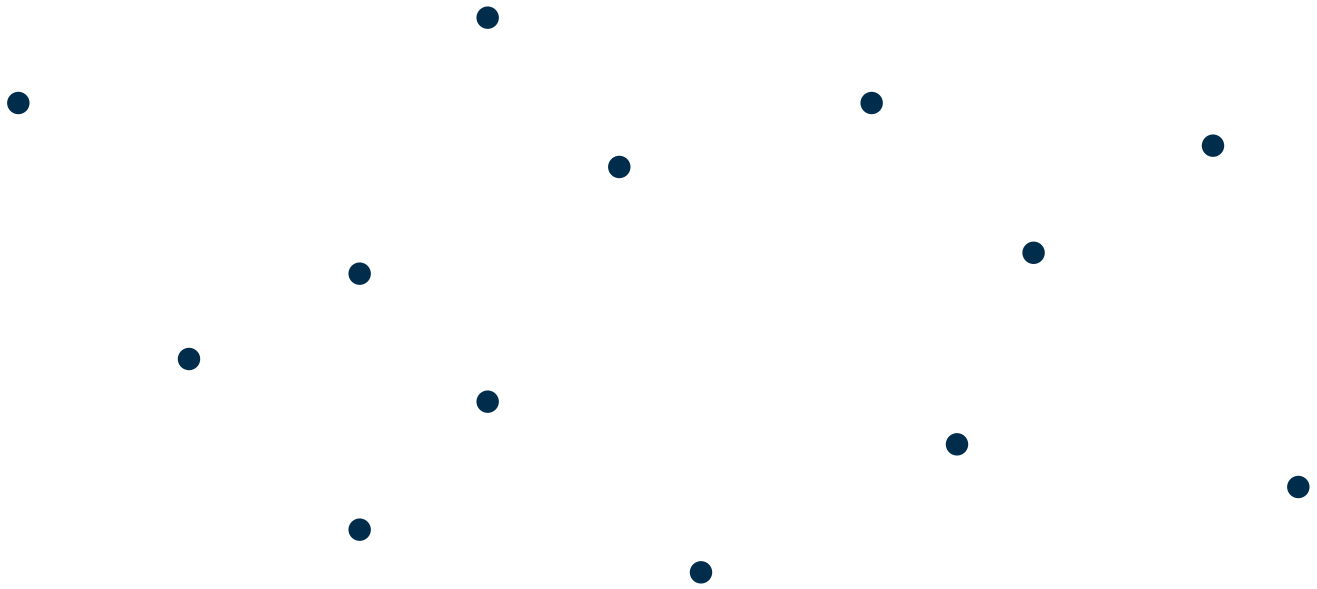
Given: set of points



Additional problem

Given: set of points

Task: find two points with maximum distance



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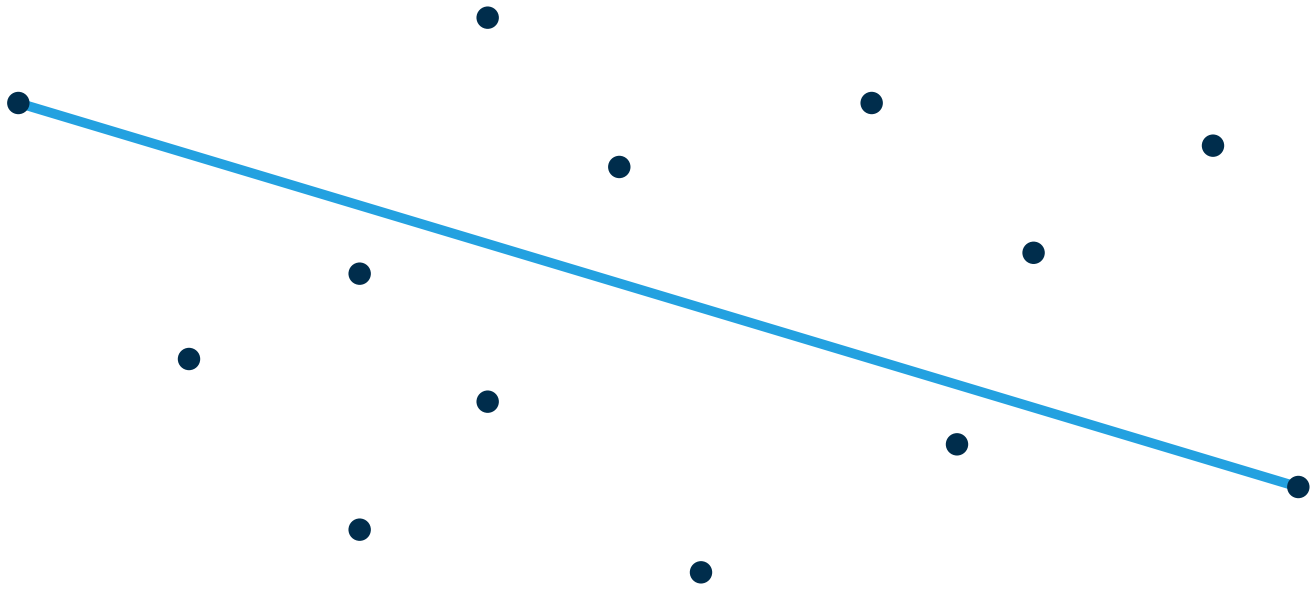

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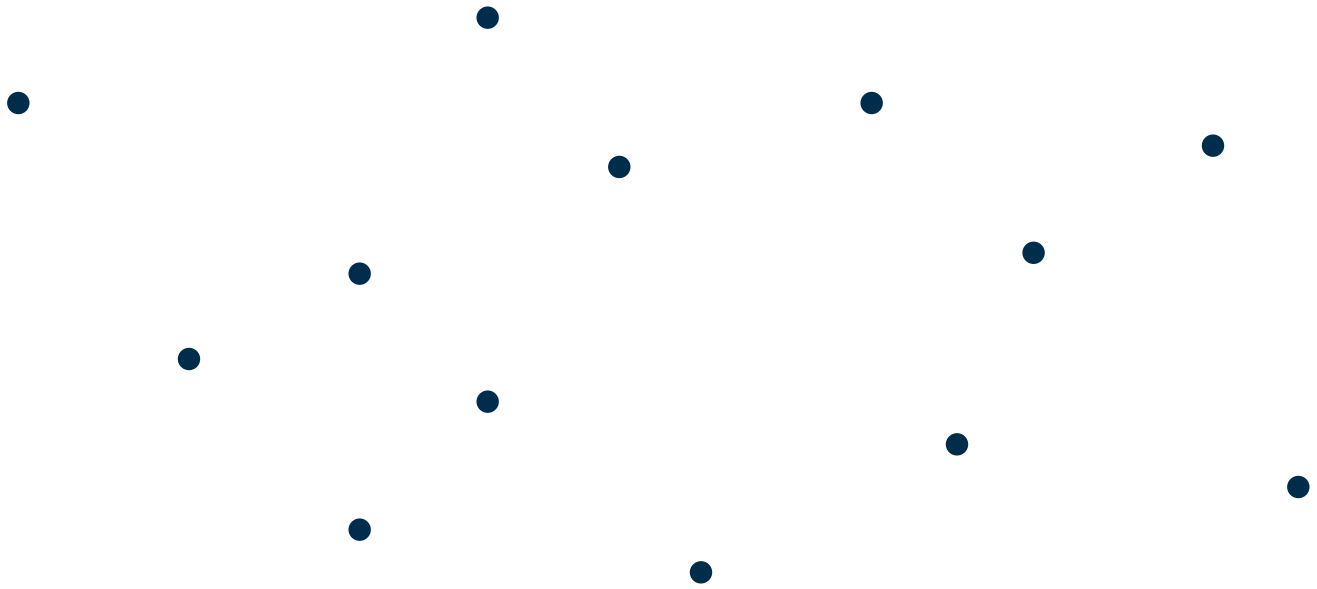

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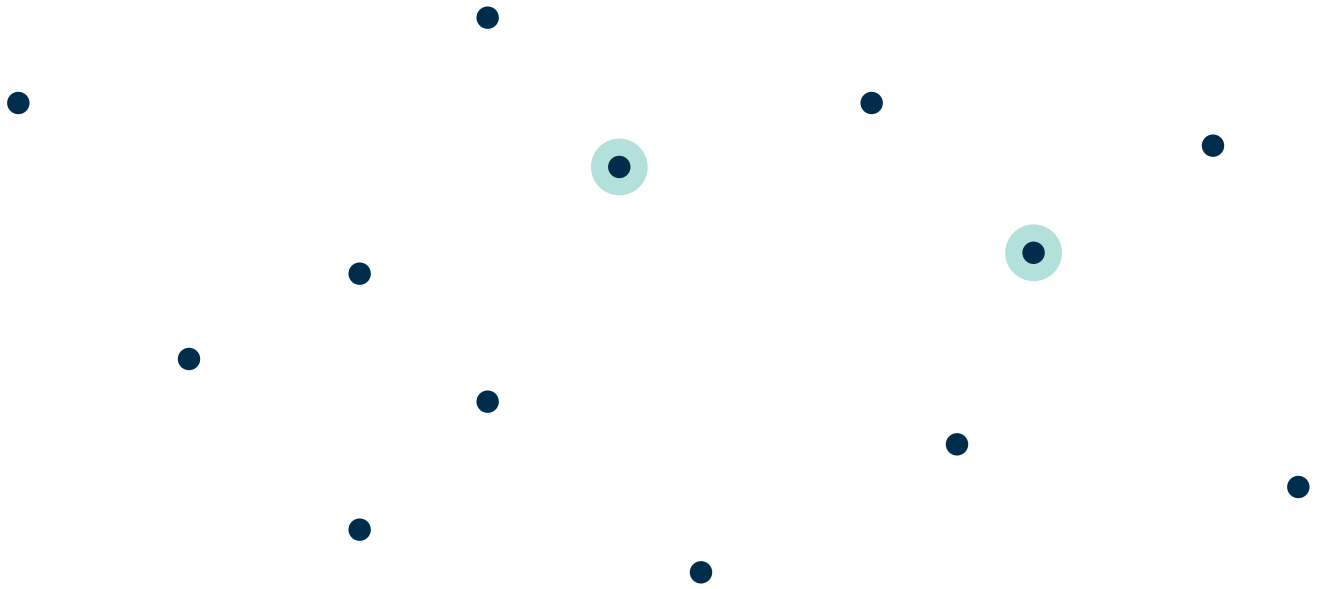

- Can we rule out these two points?

Additional problem

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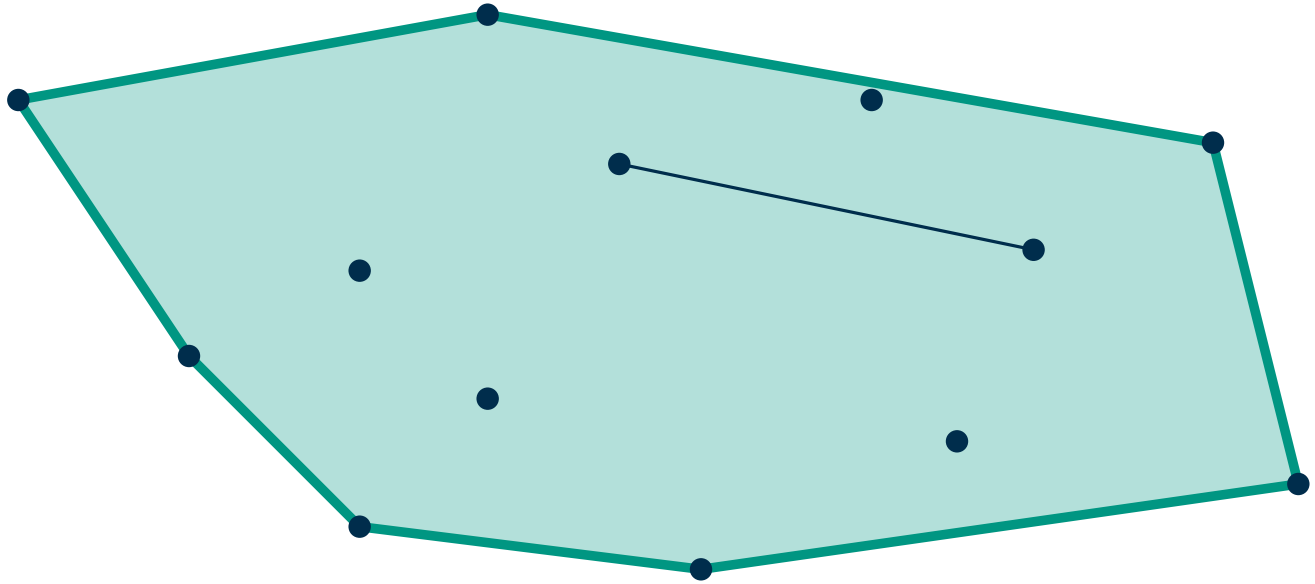
Task: find two points with maximum distance



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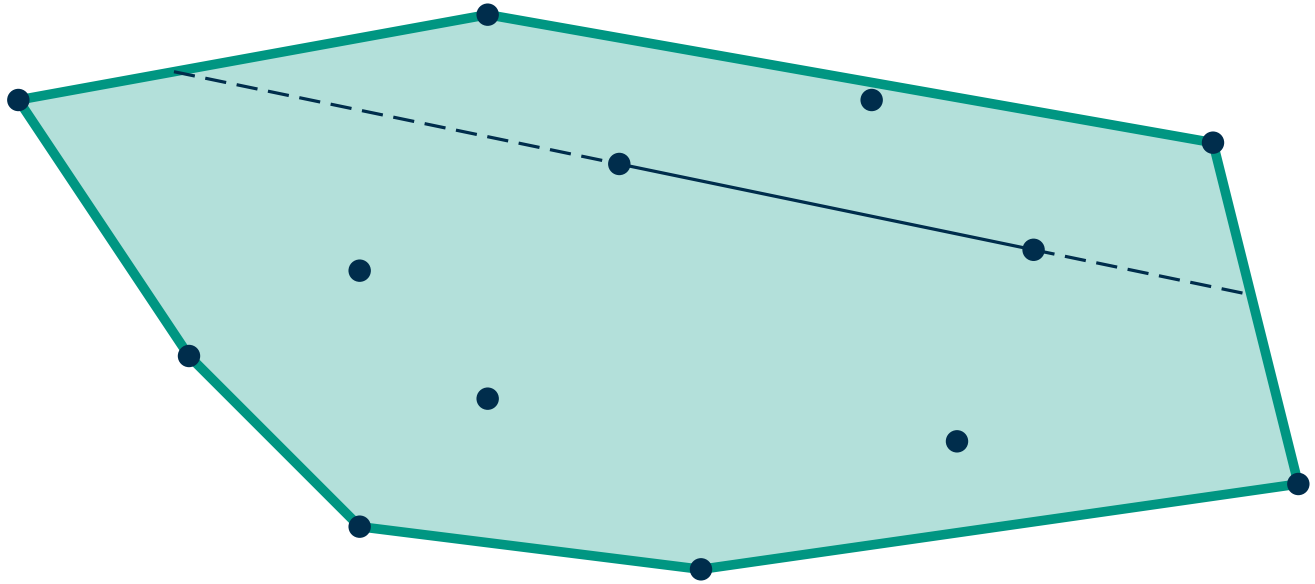

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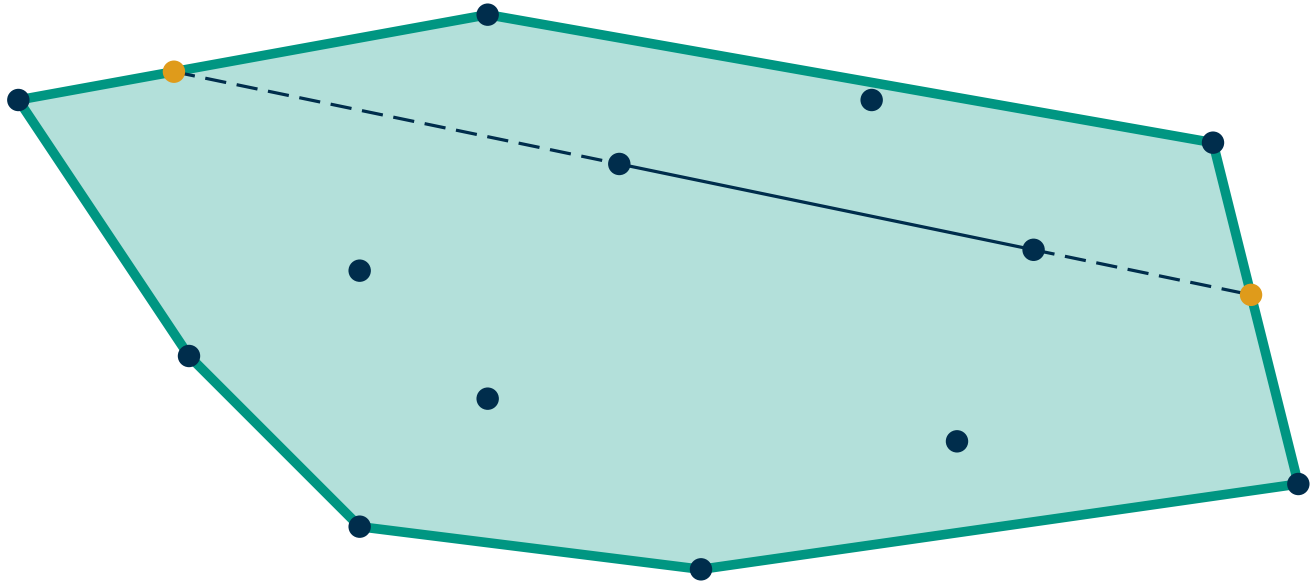

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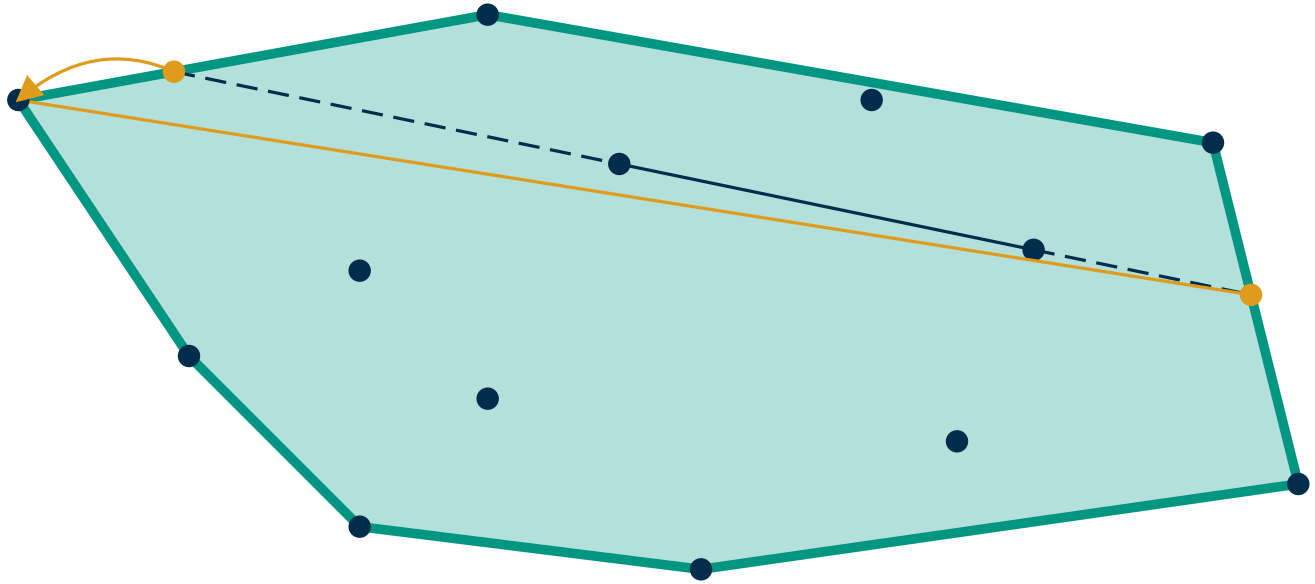

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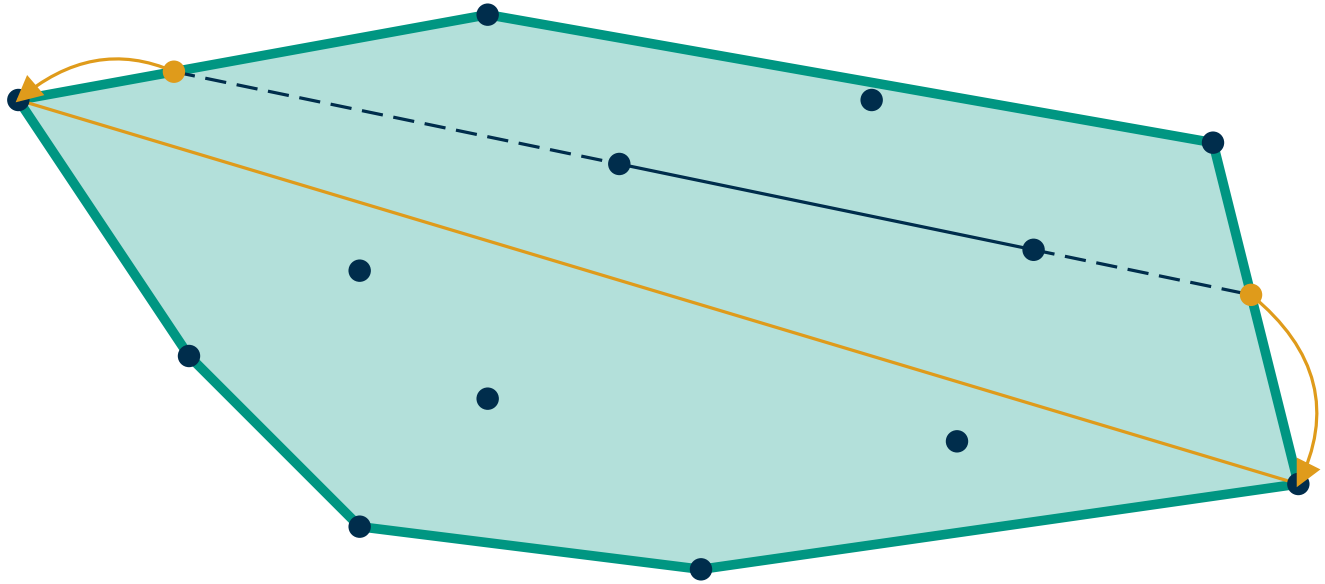

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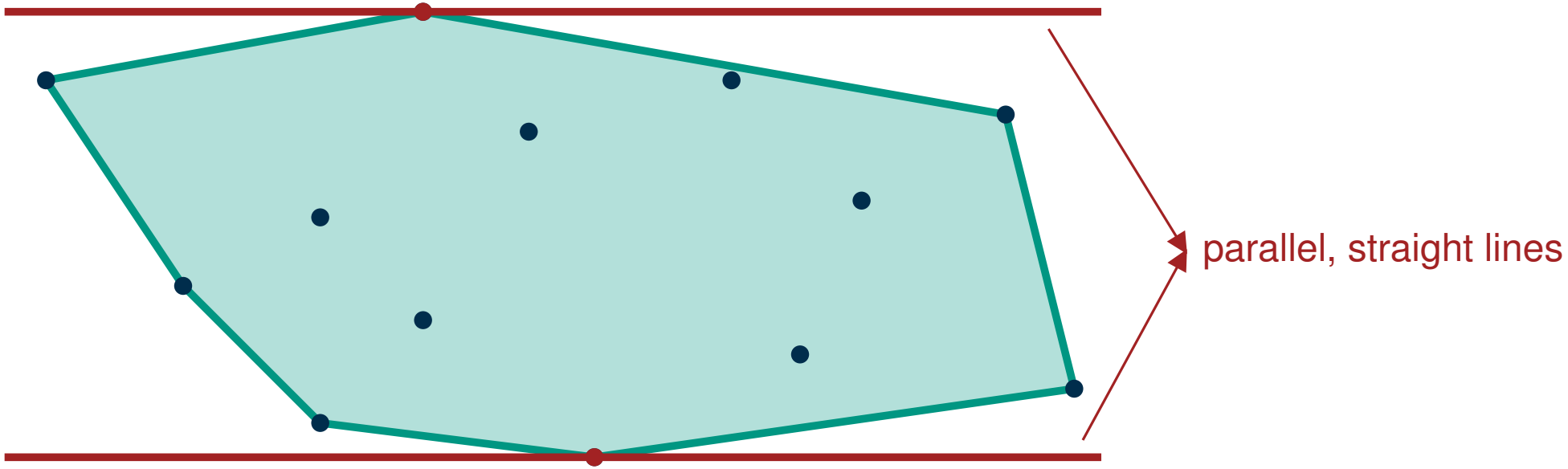

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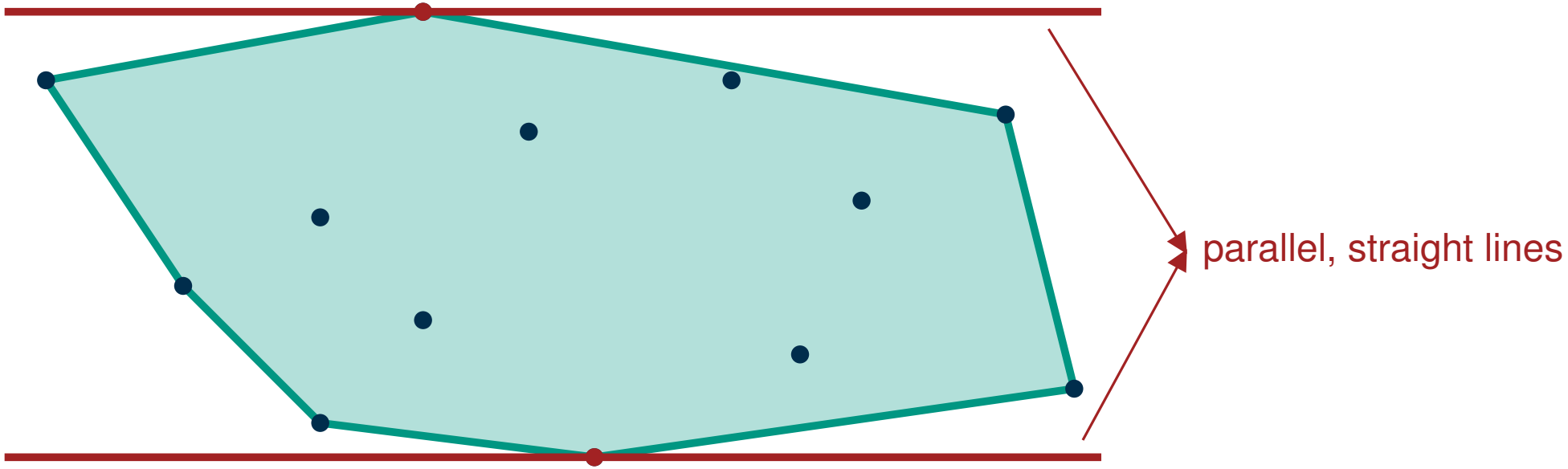
- Show: most separated points are *antipodal*

Additional problem

Given: set of points

Task: find two points with maximum distance



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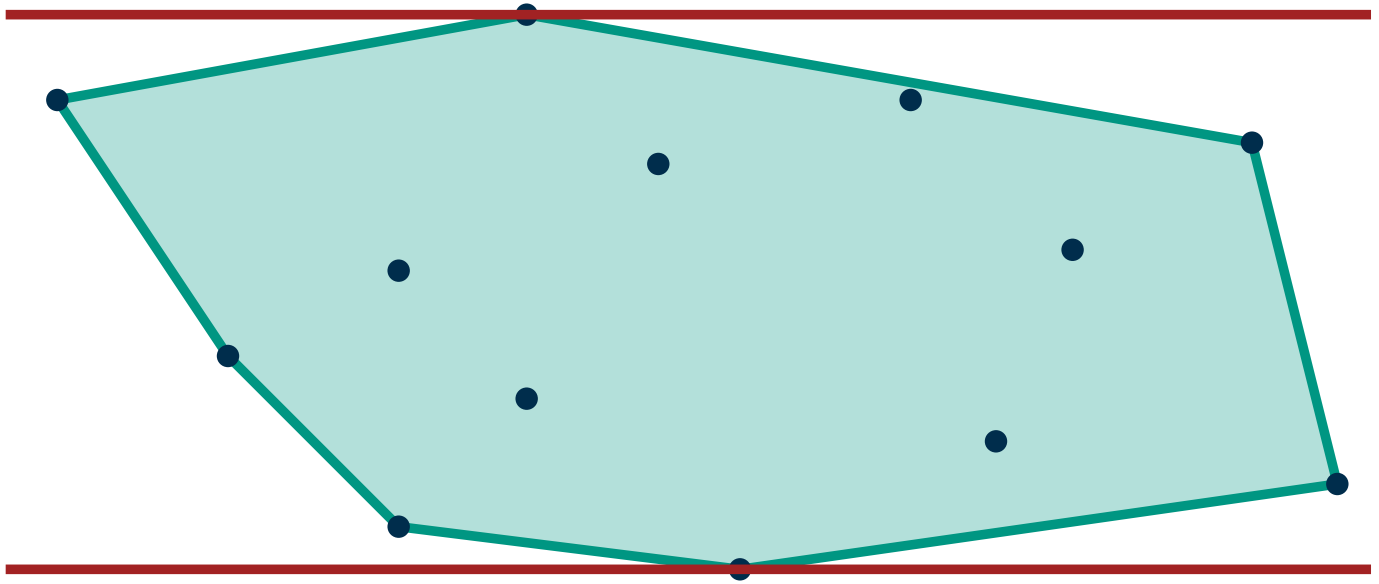

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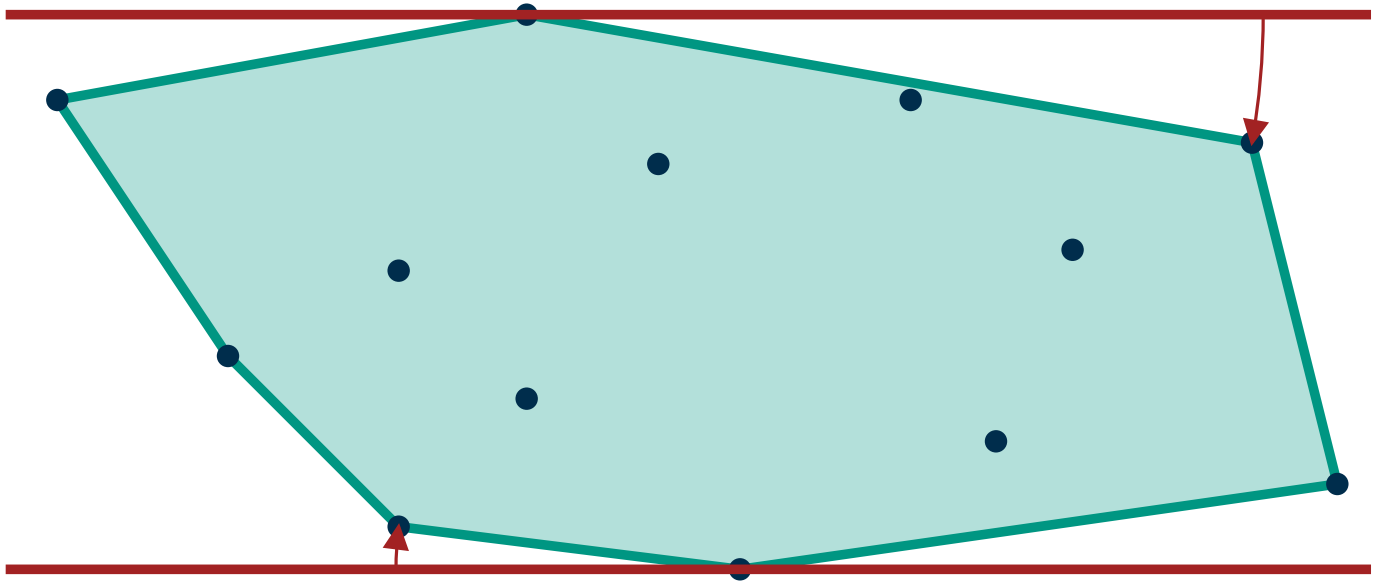

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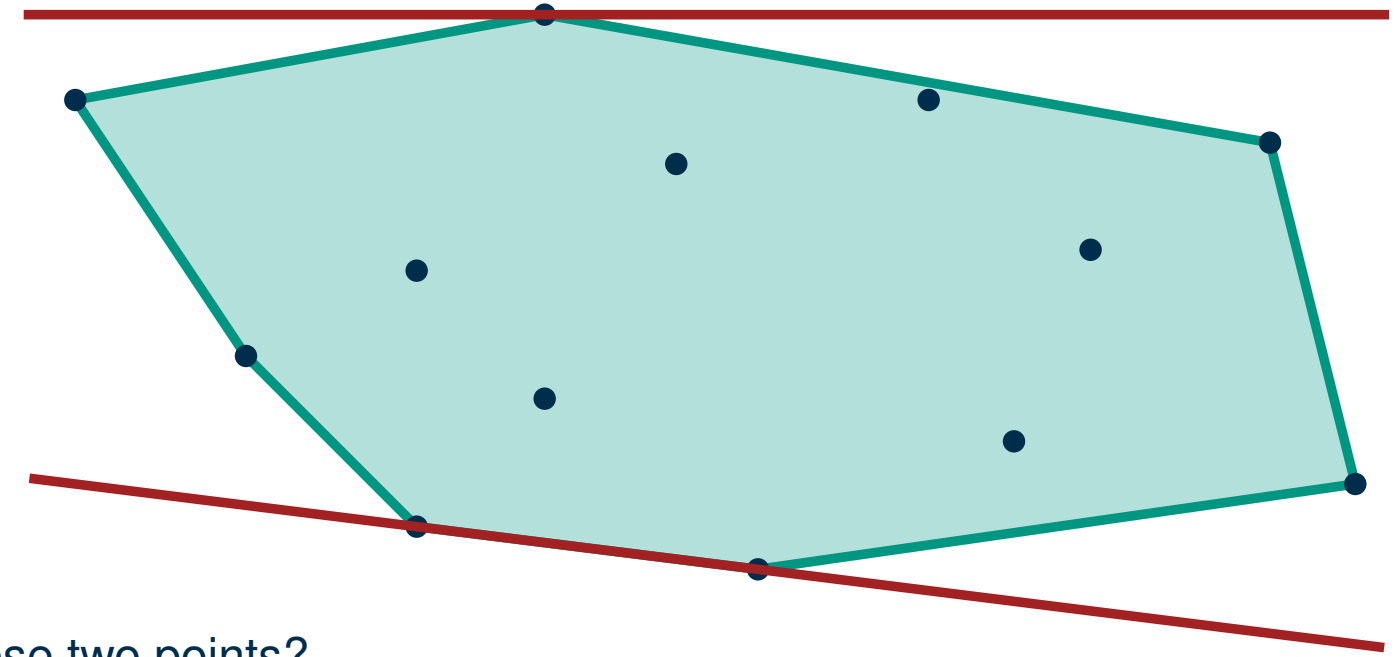

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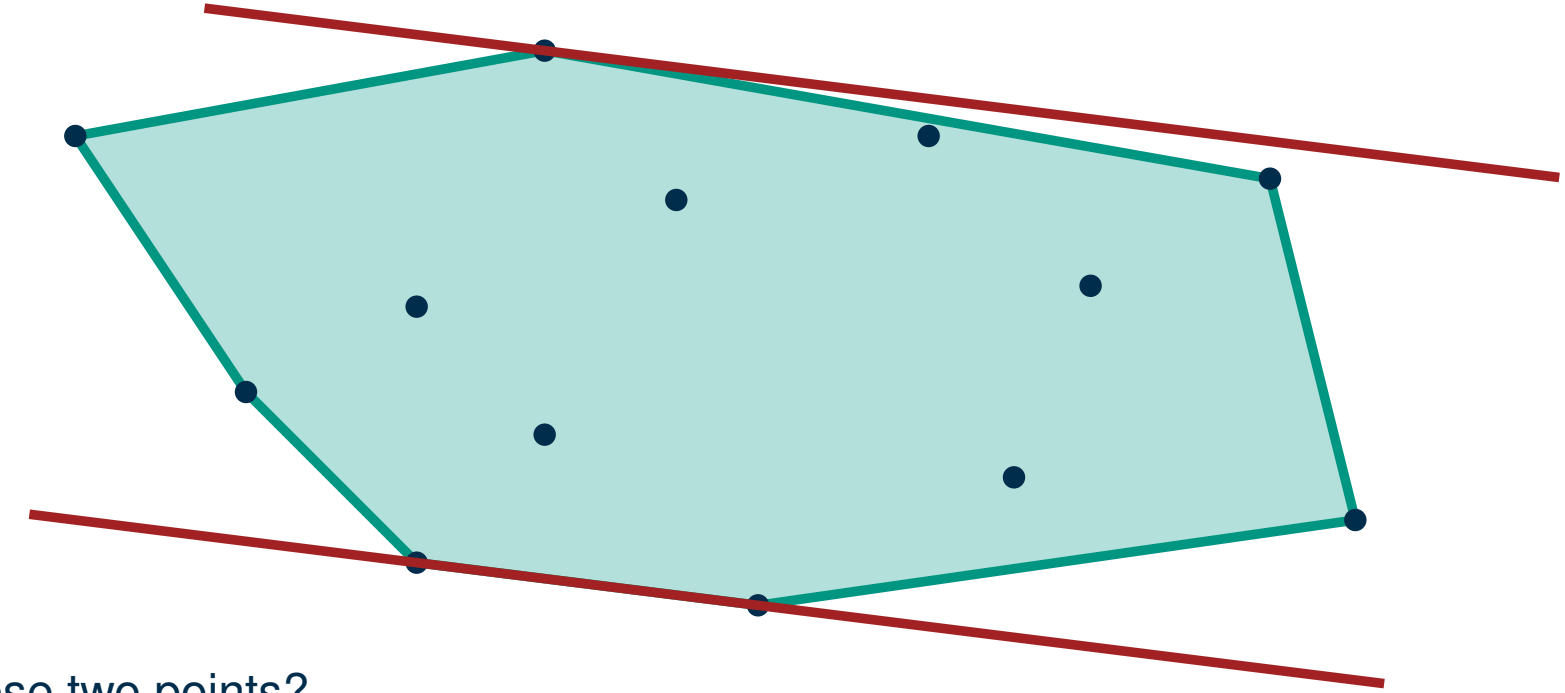

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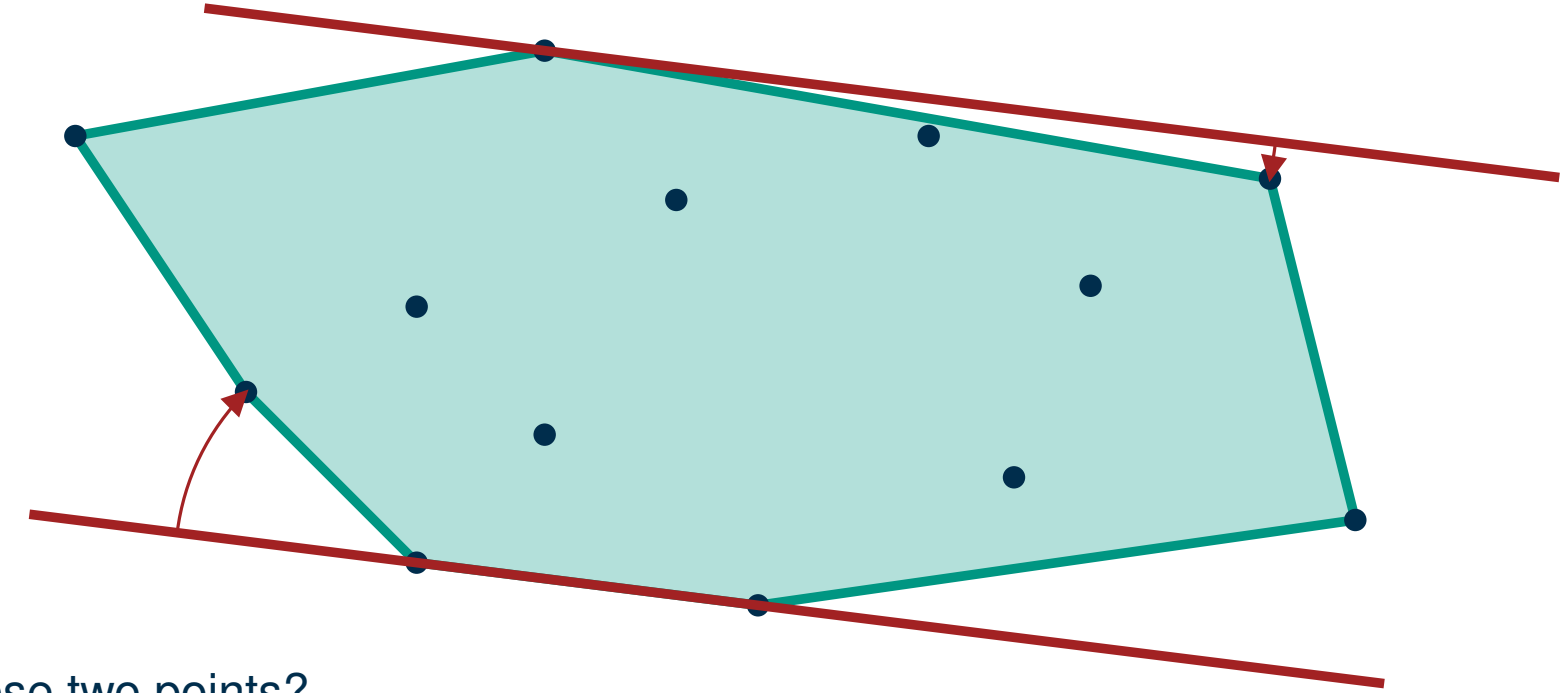

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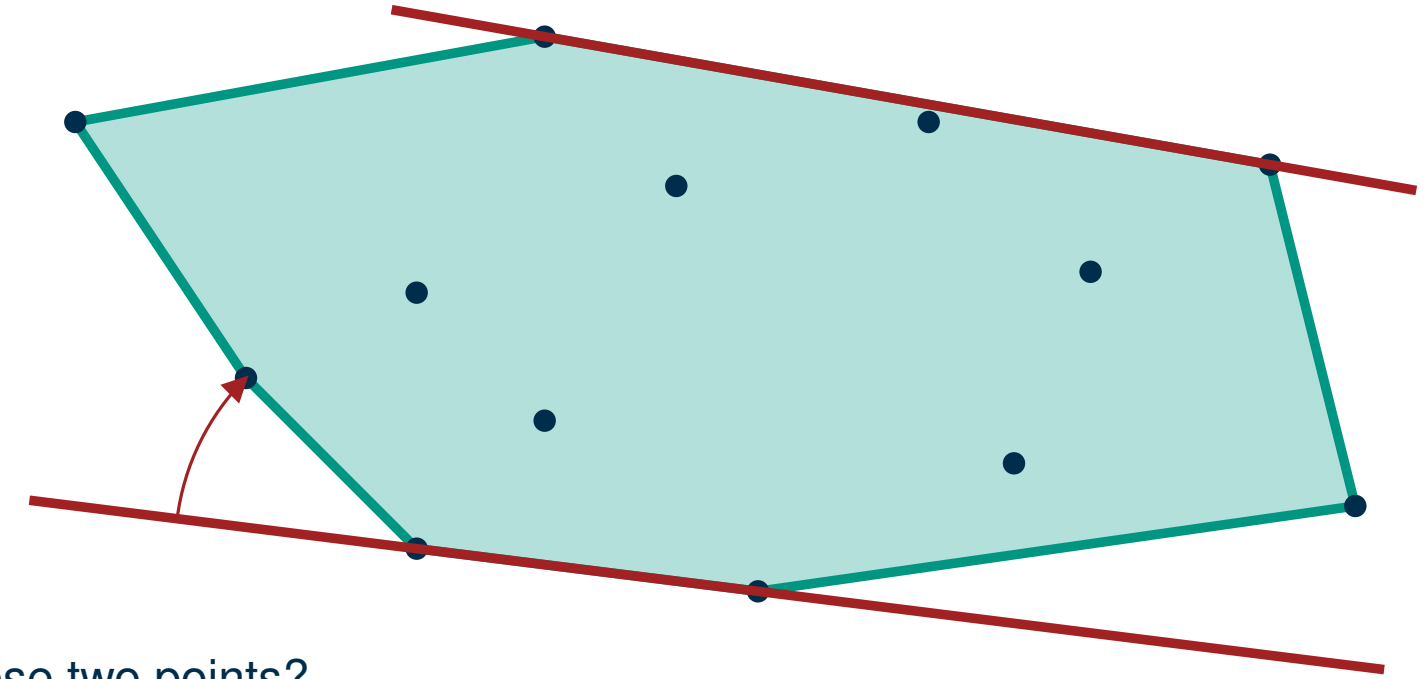

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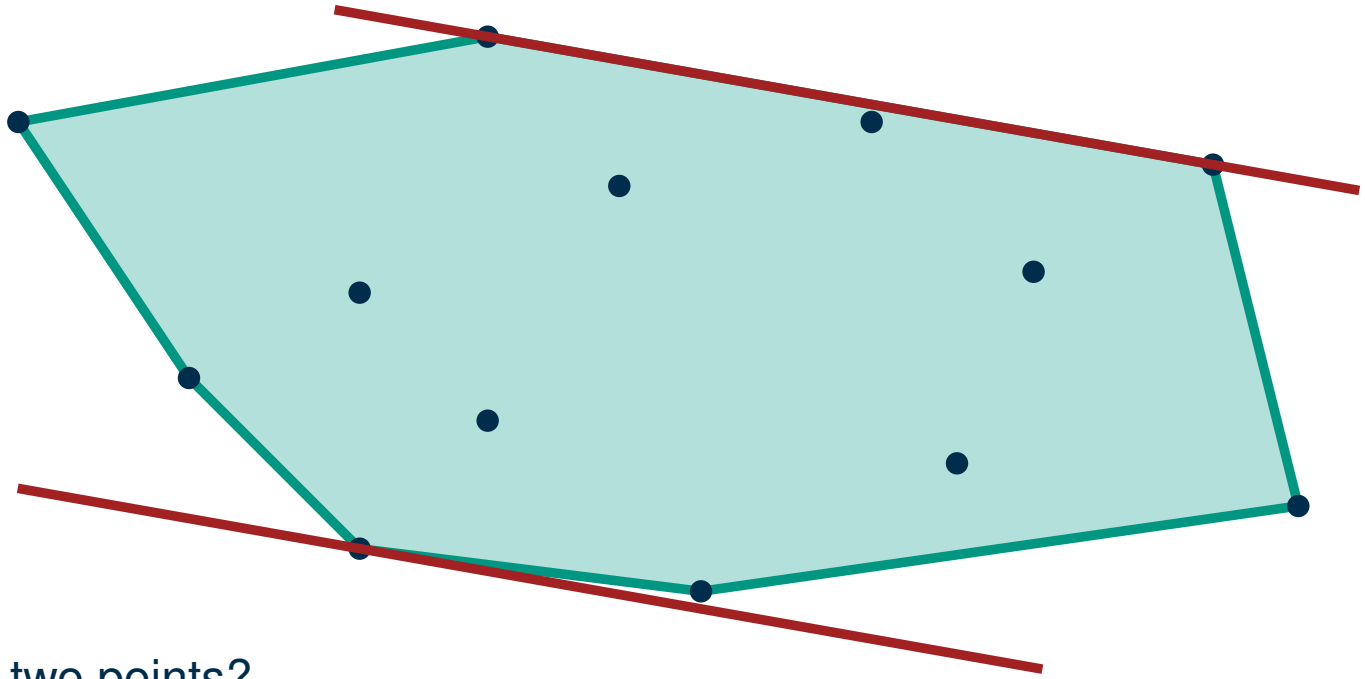

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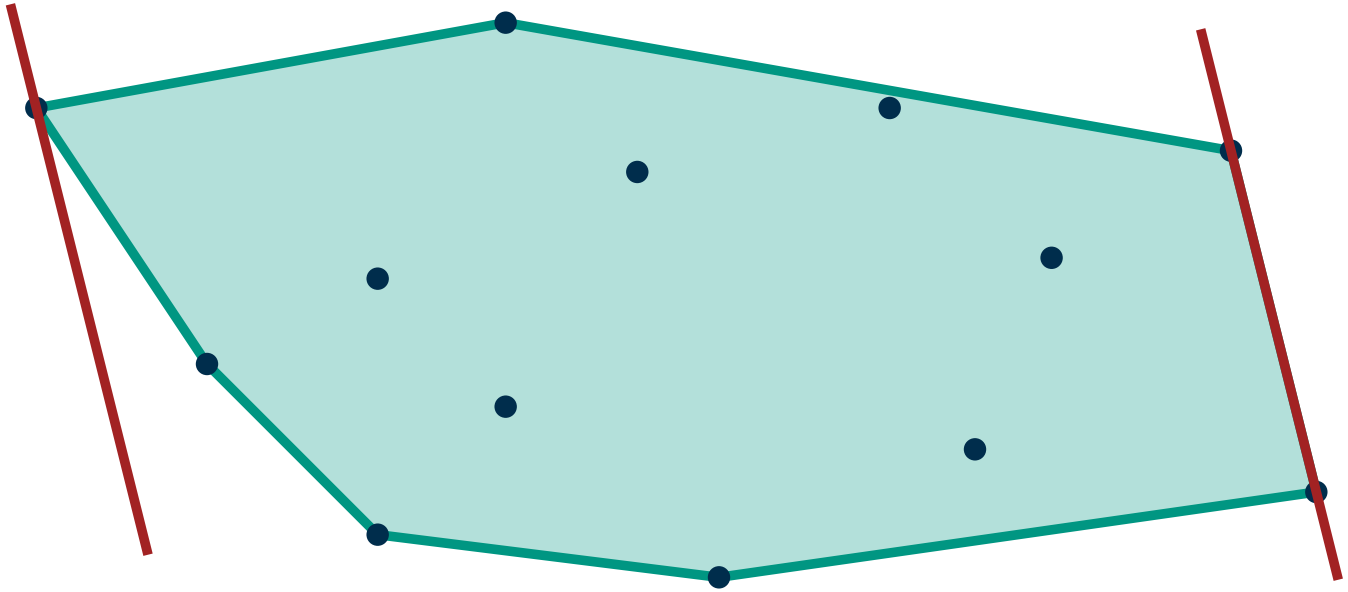

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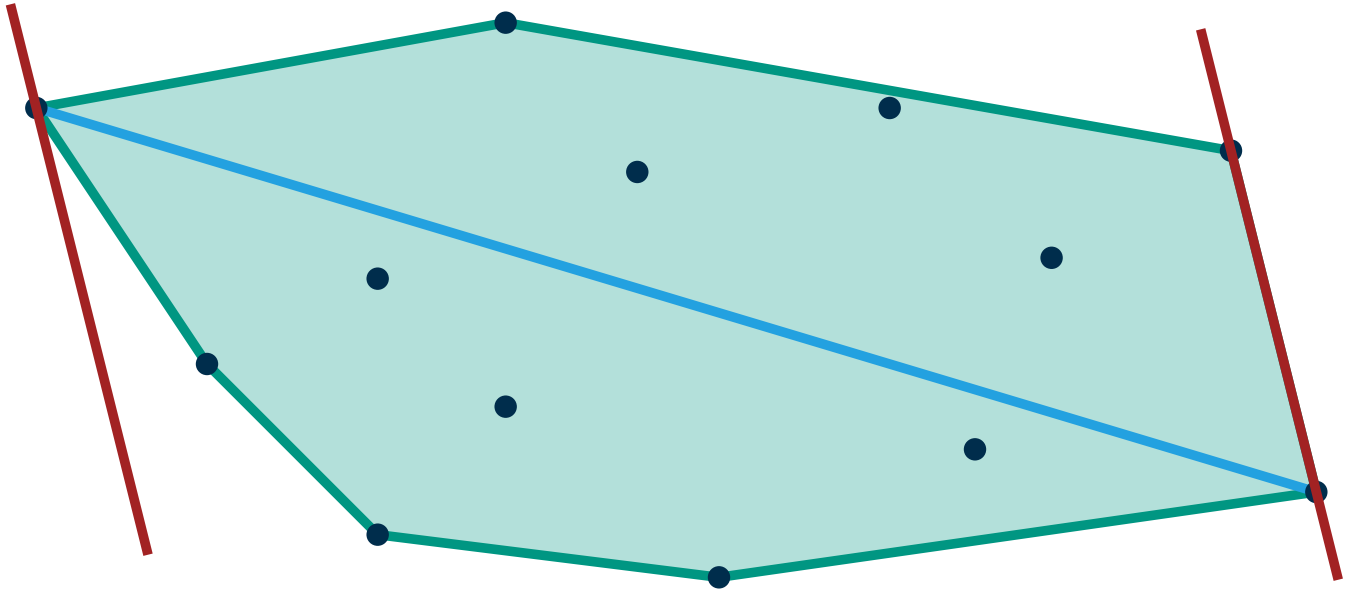

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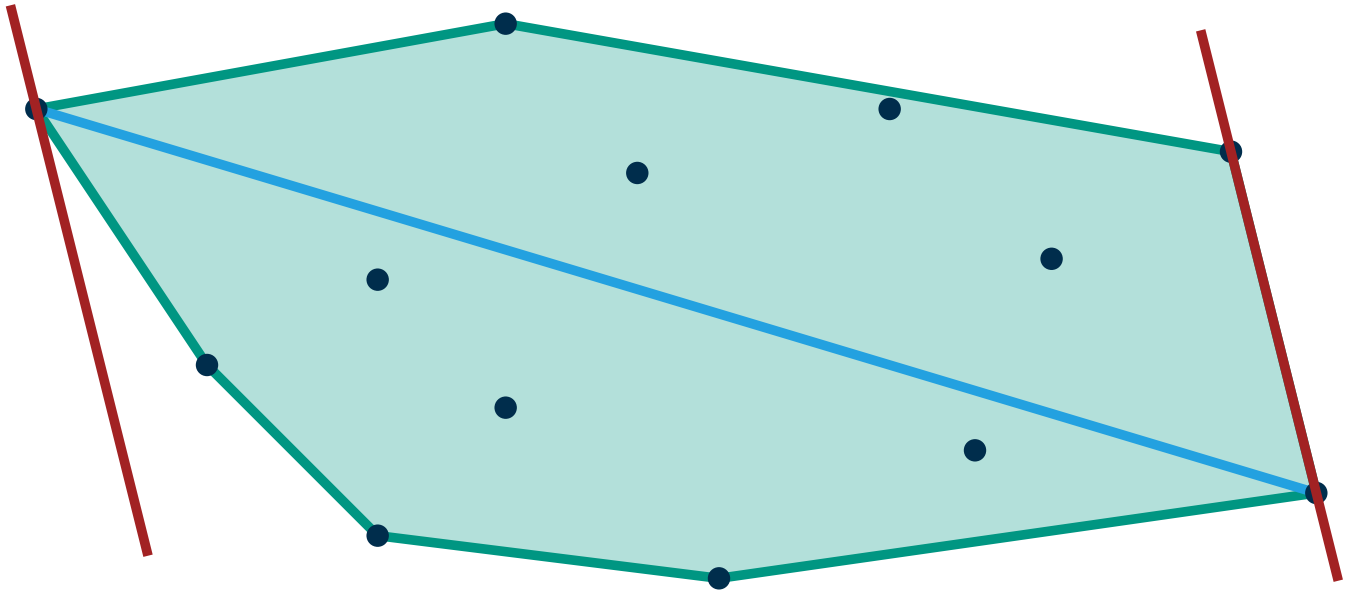

“rotating calipers”

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