

i s t a n b u l t e c h n i c a l u n i v e r s i t y
a r c h i t e c t u r a l d e s i g n c o m p u t i n g g r a d u a t e p r o g r a m
d a d s 2 0 1 1 : a s p r i n g t i m e v e n t u r e

The Digital Shape or...

Mind the Gap Reloaded!

Lecture II

Geometry: A Bit of History

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What Is Geometry?

- **geo-** earth, **-metri** measurement (Ancient Greek)
- Branch of mathematics concerned with questions of
 - shape
 - size
 - relative positions of figures
 - properties of space
- One of the two main fields of pre-modern mathematics (the other one being algebra)

Historical Timeline

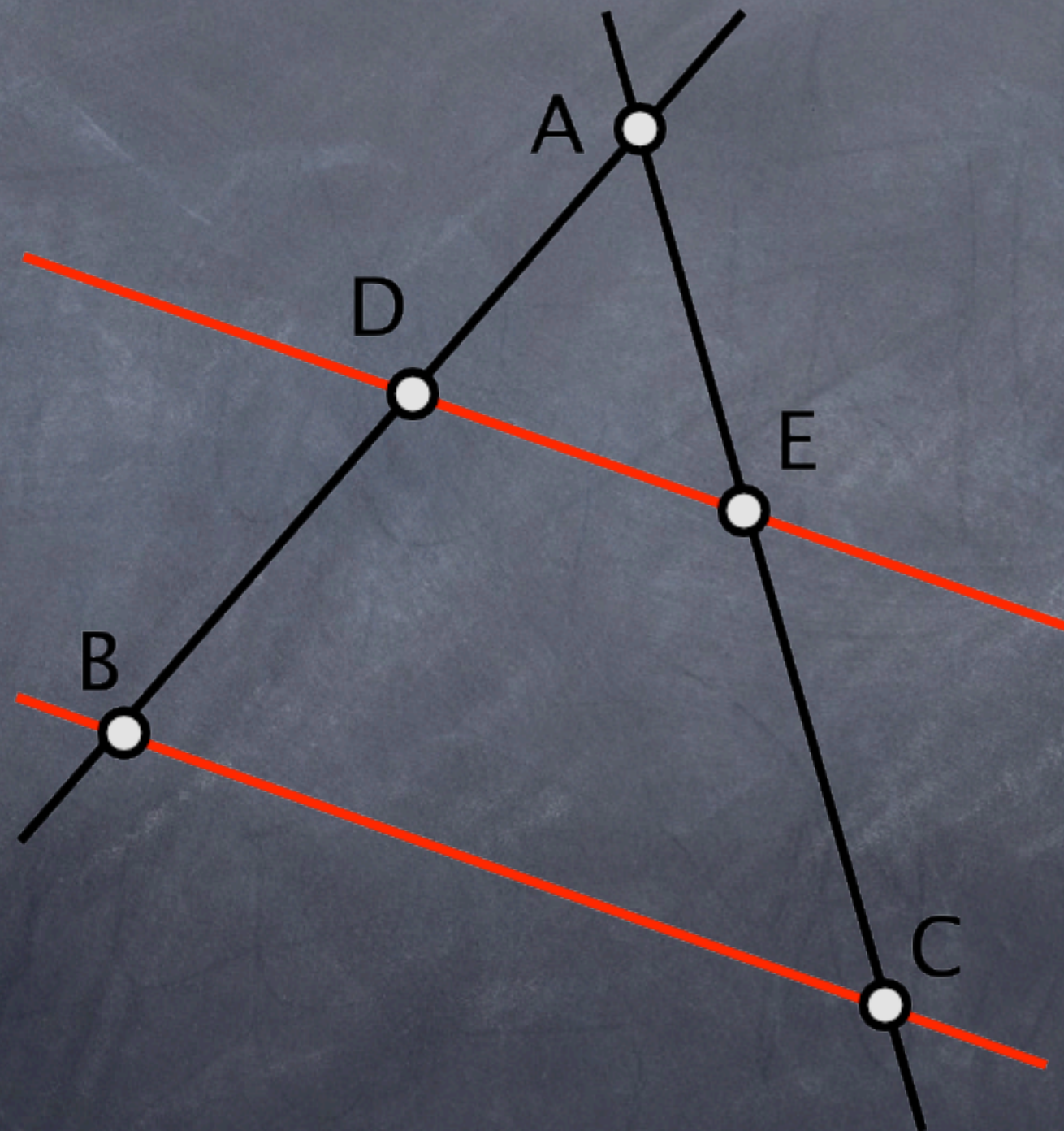


Meanwhile; Indians and Chinese have been building their own mathematics ...
and geometry!

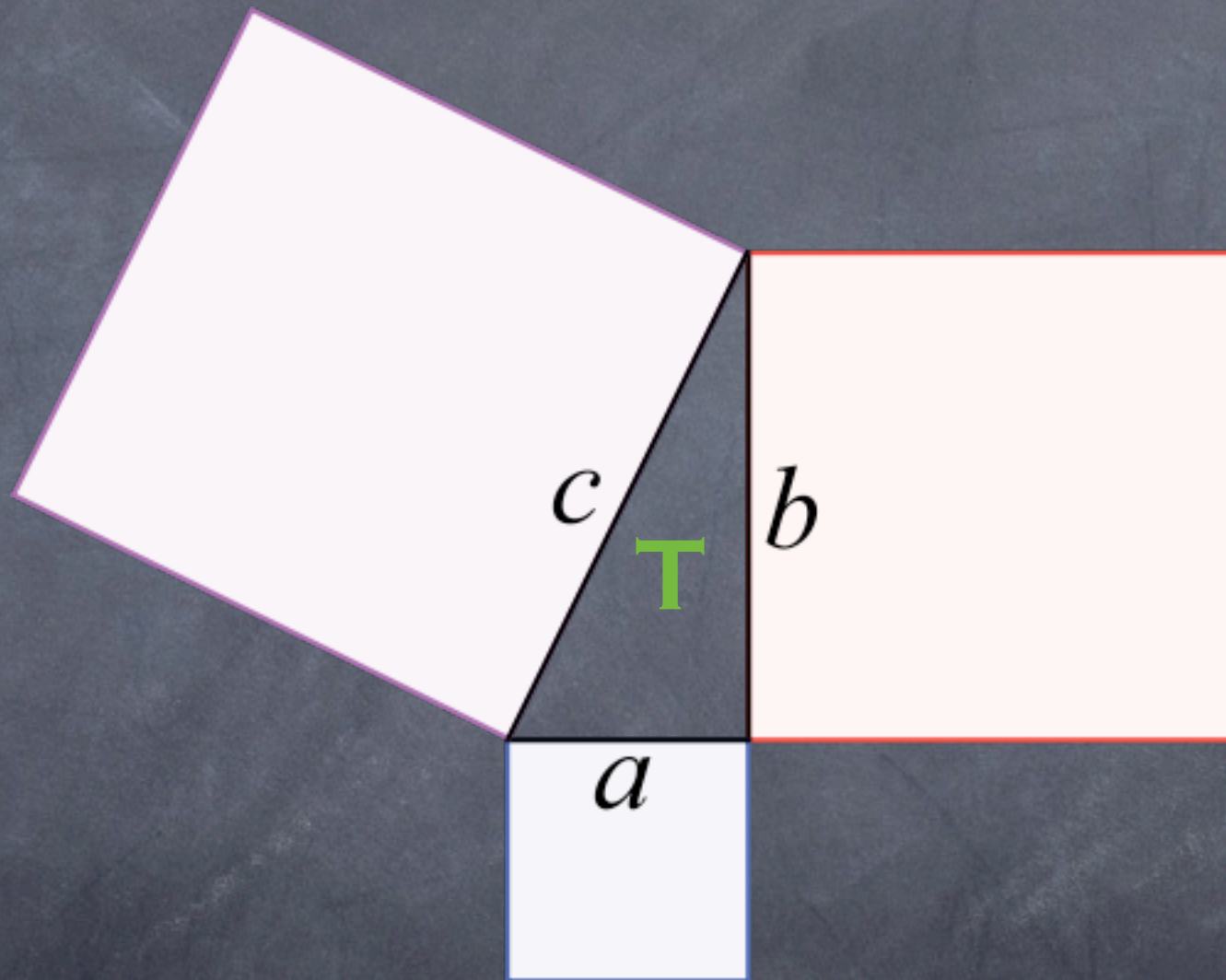
Greeks

- Geometry evolved from trial-and-error based measurement towards deduction
- Abstractions mattered more than instances
- Thales: Similar Triangles
- Pythagoras: That Theorem
- Plato-Aristotle: Abstraction, Deduction
- Euclid: Axiomatization

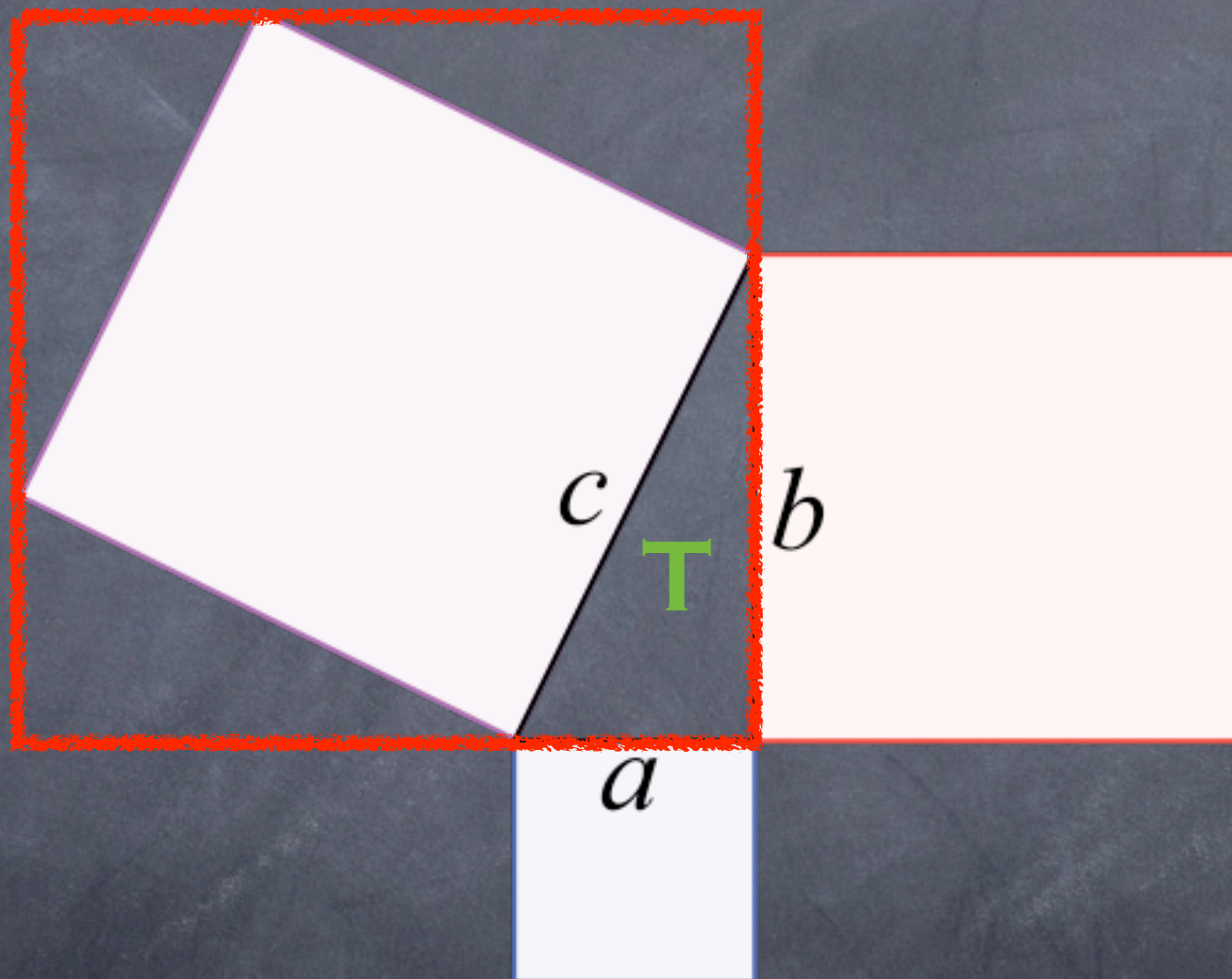
Thales Theorem



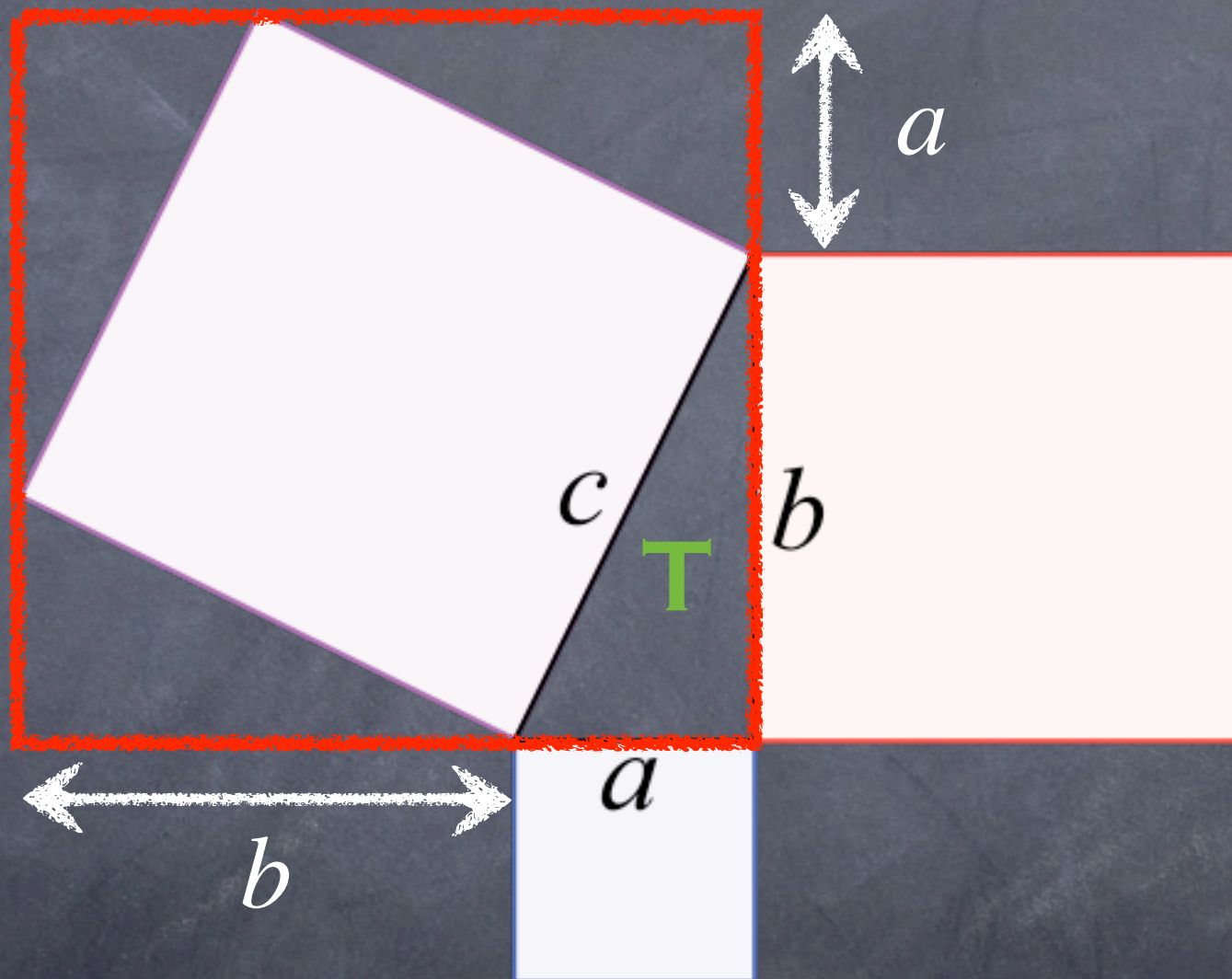
Pythagoras Theorem



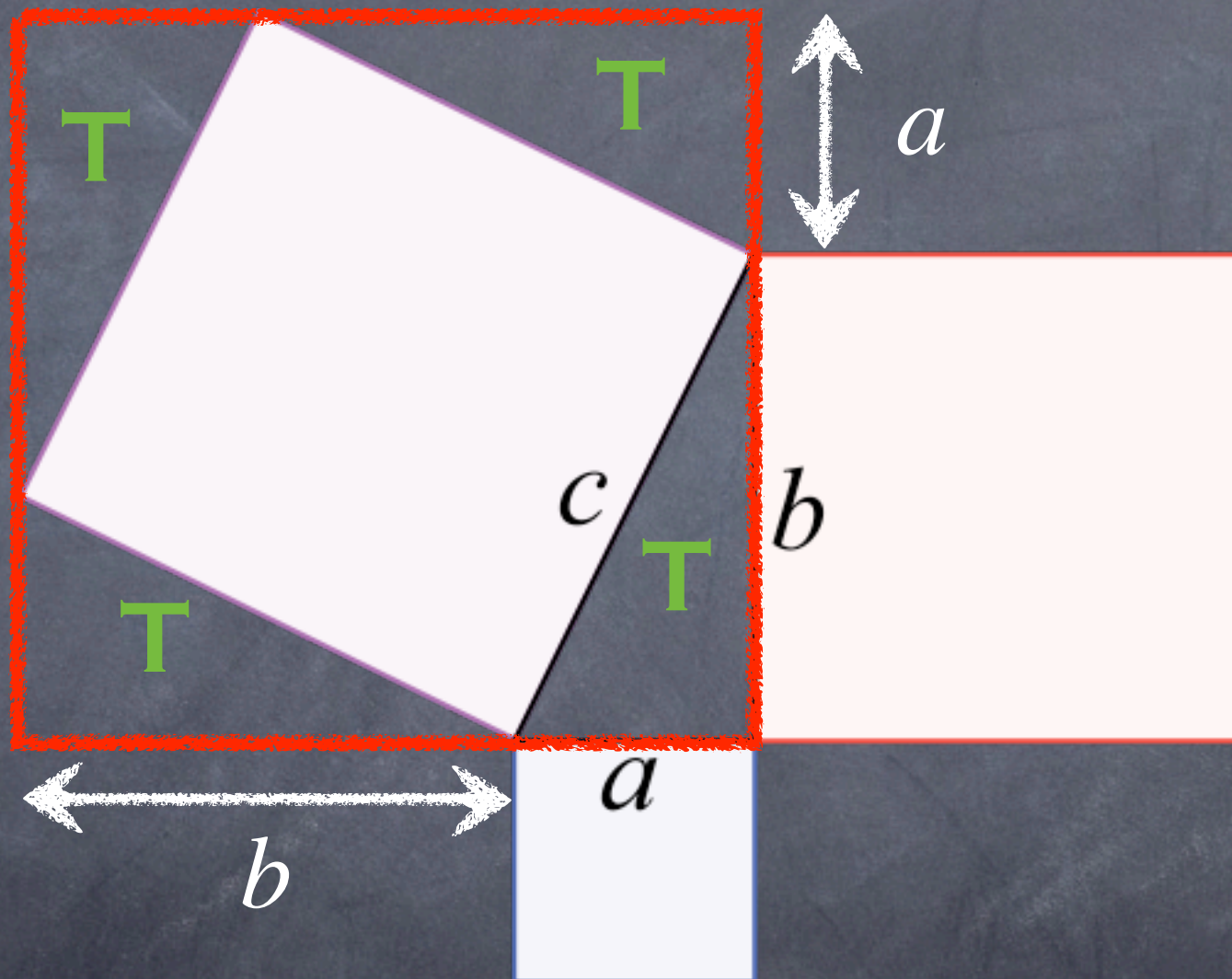
Pythagoras Theorem



Pythagoras Theorem



Pythagoras Theorem



Deduction vs. Induction

Until Greeks, geometrical inference was mainly inductive

- **Induction:** from particular to general
- **Deduction:** from general to particular

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Until Greeks, geometrical inference was mainly inductive

- **Induction:** from particular to general

- **Deduction:** from general to particular

- **Inductive argument:**

All crows that I saw so far are black, (then) a crow is a black bird

- **Deductive argument:**

(If) a crow is black, (then) the crows (that I will see) should be black

The Elements

- Euclid (325-265 BC) was the first to bring the axiomatic view to a branch of mathematics via **The Elements of Geometry**
- An **axiom** is a proposition that is not proved nor demonstrated but considered to be either **self-evident** or **subject to necessary decision**
- A theorem is built upon axioms via logical deduction
- Collection of theorems lead to a mathematical theory

Euclid's Five Axioms

1. Any two points can be joined by a straight line.
2. Any finite straight line can be extended in a straight line.
3. A circle can be drawn with any center and any radius.
4. All right angles are equal to each other
5. (Parallel Postulate)

The Parallel Postulate

IF two straight lines in a plane are crossed by another straight line (called the transversal) and the interior angles between the two lines and the transversal, lying on one side of the transversal add up to less than two right angles;

THEN on that side of the transversal, the two lines extended will intersect.

How would you depict the parallel postulate?

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Where is “parallel” in the parallel postulate?

Playfair's Axiom

There is at most one line that can be drawn parallel to another given one by an external point

Playfair's axiom is the converse of Euclid's 5th Axiom

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