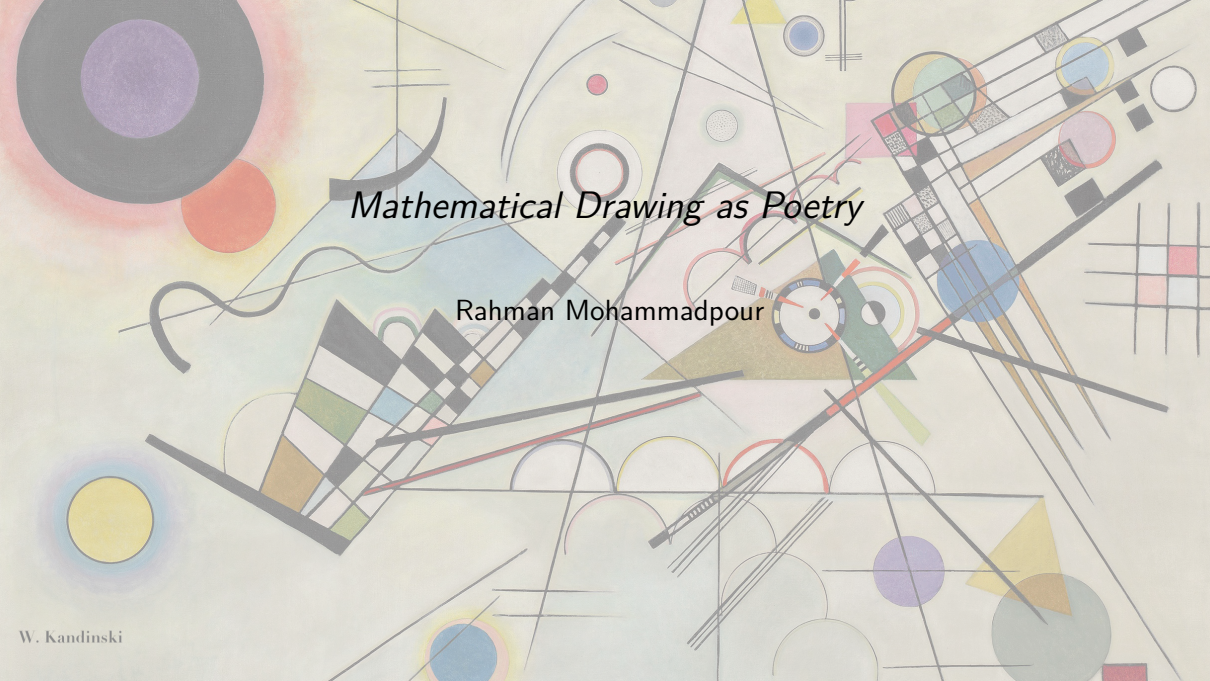


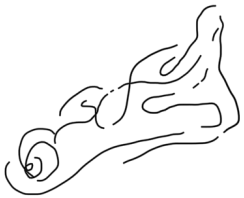
Mathematical Drawing as Poetry

Rahman Mohammadpour

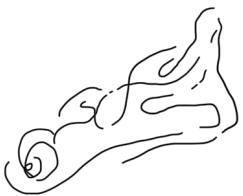
In the green sky I saw the new moon reaping,
And minded was I of my own life's field:
What harvest wilt thou to the sickle yield
When through thy fields the moon-shaped knife goes sweeping?

Hafez

- Various reasons for the existence (!) and use of drawings in mathematics:
  - improving mathematical write-ups
  - pedagogical purposes
  - facilitation in the process of perception
  - a different kind of representation
  - etc.



- Various reasons for the existence (!) and use of drawings in mathematics:
  - improving mathematical write-ups
  - pedagogical purposes
  - facilitation in the process of perception
  - a different kind of representation
  - etc.
- Mathematicians use the language of mathematics to talk about abstract objects in the realm of mathematics - if we can distinguish between the two at all!



Detail of Hall of Bulls, Lascaux II

- Learning and the desire to pass on knowledge were crucial to the development of human civilisations and led in particular to the invention of writing systems.
- There is ample (pre-)historical evidence that drawings of figures and bodies played a crucial role in the transmission and documentation of existing knowledge from one generation to the next.

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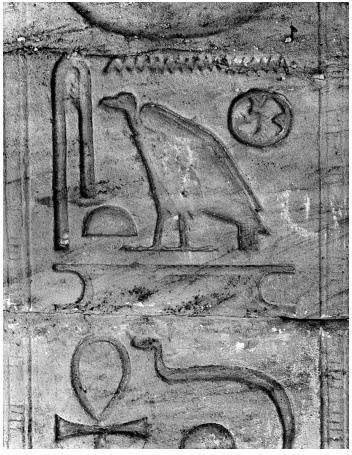
In later civilisations, too, we could observe how figures and lines facilitated communication between individuals, of which the hieroglyphics in ancient Egypt are a notable example; mathematics was no exception.

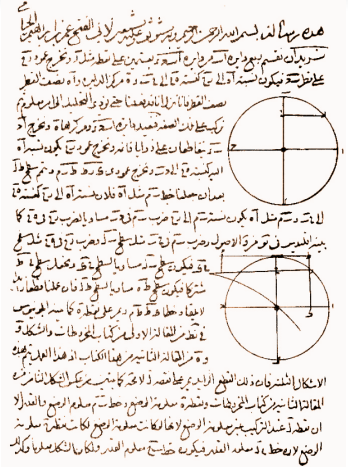


Hieroglyphs at Amada, at temple founded by Tuthmosis III

The complexity of mathematics demands more powerful and expressible tools for explaining and describing the mathematical universe.

The complexity of mathematics demands more powerful and expressible tools for explaining and describing the mathematical universe. As a result, relying on one language, one form of *communication*, and one form of writing is not only sophisticated but also slippery.

- We can readily see how notation plays a role different from characters in mathematical scripts.
- The invention of mathematical symbols (notation) has been a decisive factor in the spread of mathematics, and subsequently science, among various nations worldwide.



Cubic equation and intersection of conic sections, Khayyam (1048-1131)

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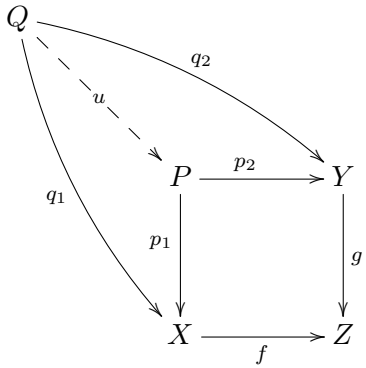
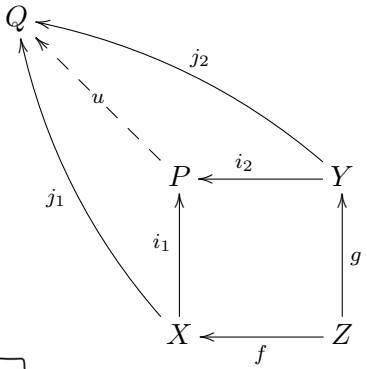
The Stokes Theorem

$$\oint_{\Gamma} \mathrm{F} \cdot \mathrm{dT} = \iint_{\mathrm{S}} (\nabla \times \mathrm{F}) \cdot \mathrm{dS}$$

A more modern mathematical symbol that appears as a drawing uses arrows!





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- To elaborate further, while we could formulate any mathematical argument precisely using a legitimate formal language, we do not always use a purely formal language to write an article.
- The problem is that one would find no sensation and creativity in a soulless sequence of simple and limited symbols! We are not machines!

My thoughts

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My thoughts

- A fascinating aspect I have realised in my mathematical drawings is their poetic role that stems from personal experience; they exist in the mind while ambiguous and undeveloped.
- I discovered, on many occasions, in my mathematical practice, that my drawings form a significant step towards understanding and deploying a mathematical idea. However, they are strangers to me at first. The moment I am about to figure them out is when I start communicating with my "self" through drawings.
- I have found the process of picturing a mathematical intuition on complex objects very similar to an artistic experience, where I, as a mathematician, would see (perceive) abstract entities and ideas that are incredibly fragile that may not be immediately realisable on a paper.

My thoughts

- This poetic form of a mathematical idea that can convey lots of information through a personal interpretation of a mathematical idea is a must in my mathematical development.
- Furthermore, I use the same feature to transfer my knowledge to a colleague without involving complicated formulas; otherwise, we cannot keep the conversation alive; we must have common sense in the form of a picture.

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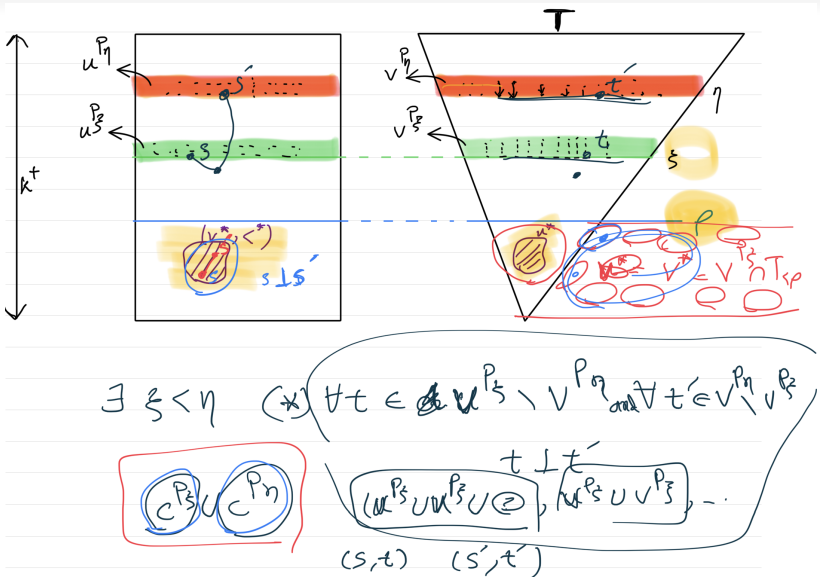
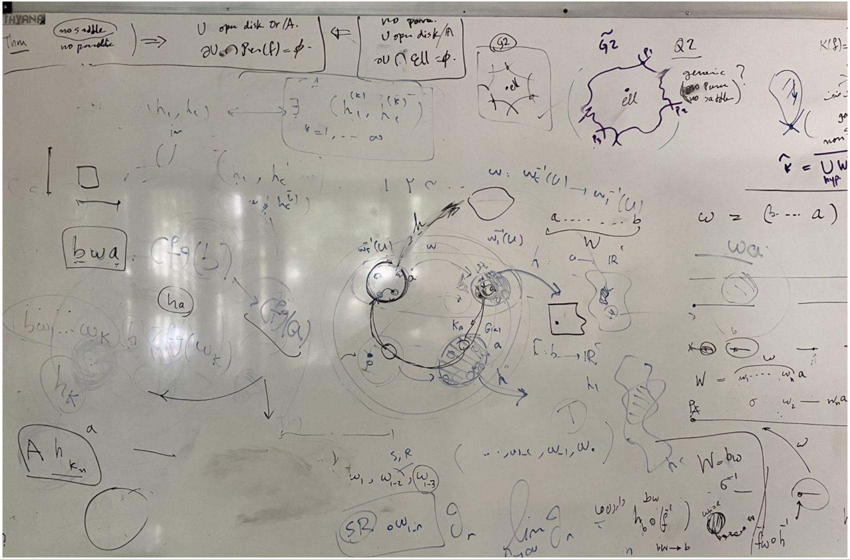

T
u^{p_η}
u^{p_ξ}
κ^+
$s \perp s'$
v^{p_η}
v^{p_ξ}
η
ξ
$\exists\, \xi < \eta \quad (*) \quad \forall t \in u^{p_\xi} \setminus v^{p_\eta}$ and $\forall t' \in v^{p_\eta} \setminus v^{p_\xi}$
$t \perp t'$
$(s,t) \quad (s',t')$


Thm
no saddle
U open disk
G2
Q2
generic ?
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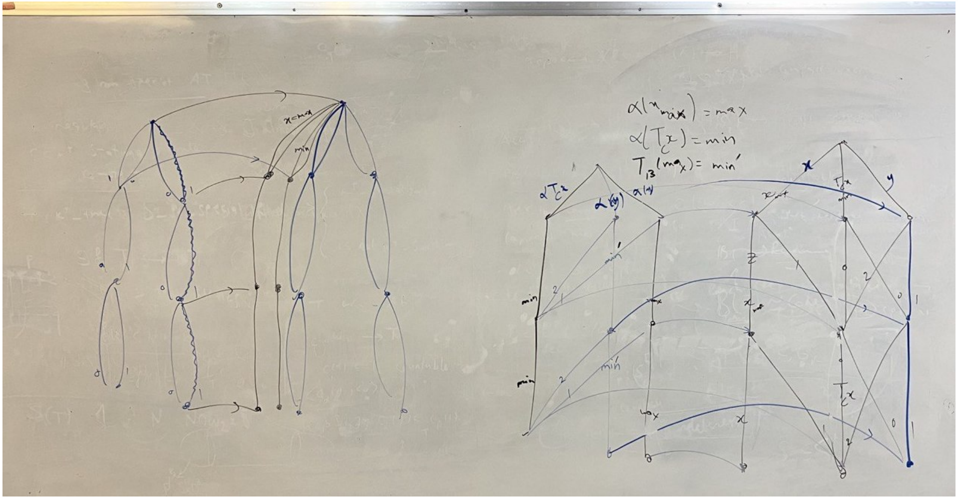
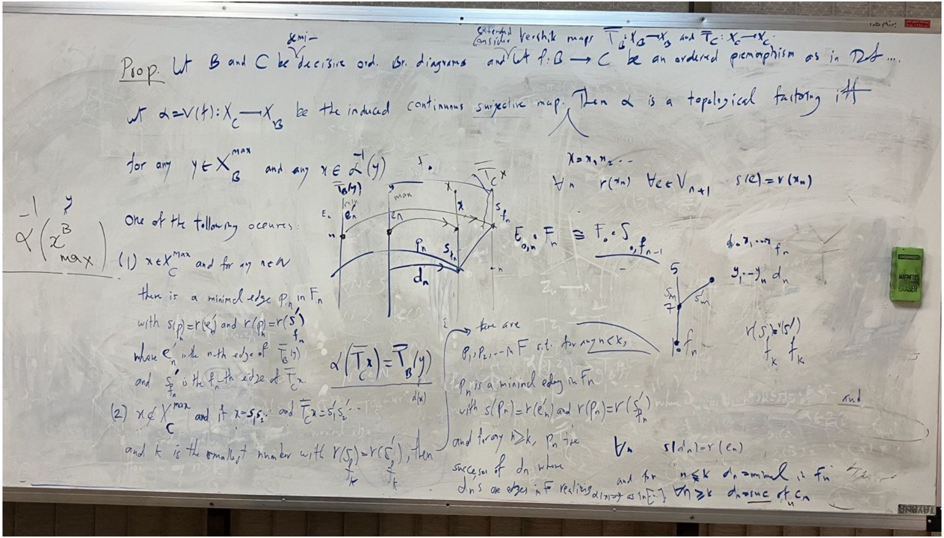
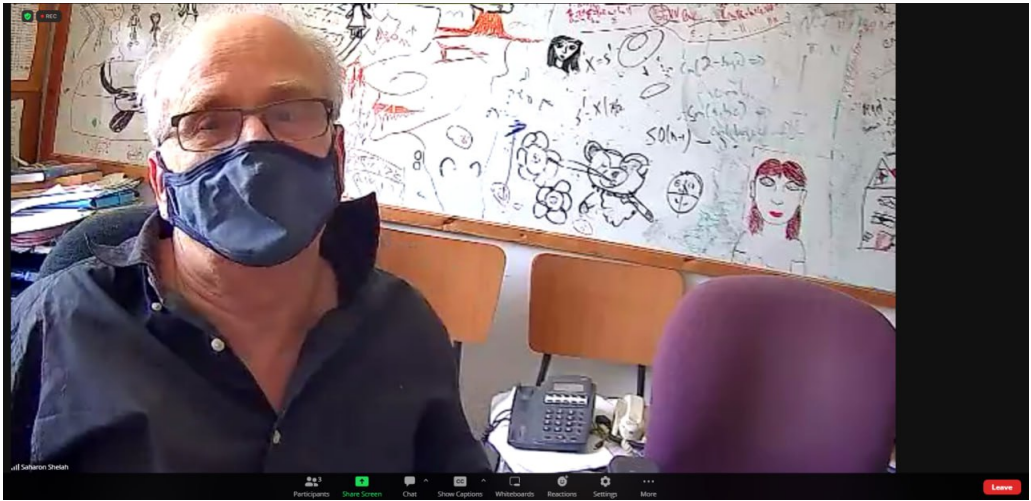

$\alpha(x_{max}) = max$
$\alpha(T_C x) = min$
$T_{13}(max) = min'$





S. Sherlah in his office, Jerusalem

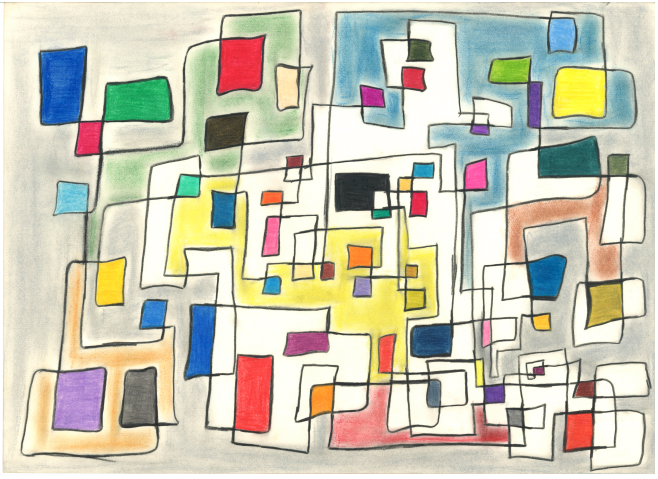
A technique

A technique

Diagonalization, mixed media on paper, A3

An axiom

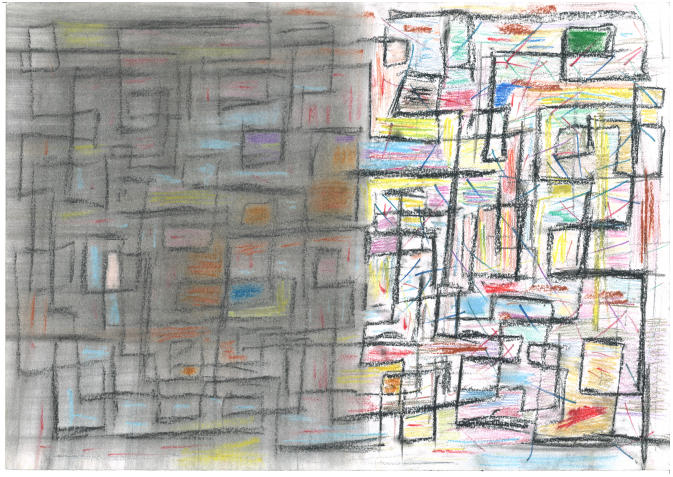
An axiom



Regularity, mixed media on paper, A3

A concept

A concept



Complexity, mixed media on paper, A3


Thank you!