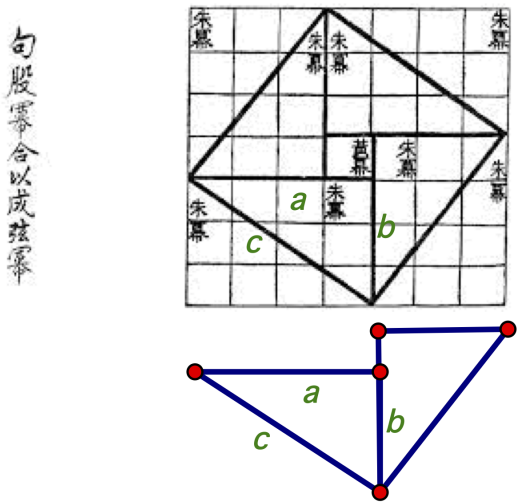
1. The Pythagorean theorem is named for Pythagoras of Samos (˜569 BCE –475 BCE). Which of the following arose to demonstrate the Pythagorean theorem based on the picture in the *Zhou Bi Suan Jing* or *Chou Pei Suan Ching*?



a) large square has area c^2
b) large square also has area $(a-b)^2 + 4(\frac{ab}{2})$
c) both
d) neither

In your notes, write out the full reasoning and steps.

2. In 4.6: The Shape of Reality? a saddle was an example of what kind of geometry?

a) Euclidean (flat)
b) spherical
c) hyperbolic
d) more than one of the above
e) none of the above

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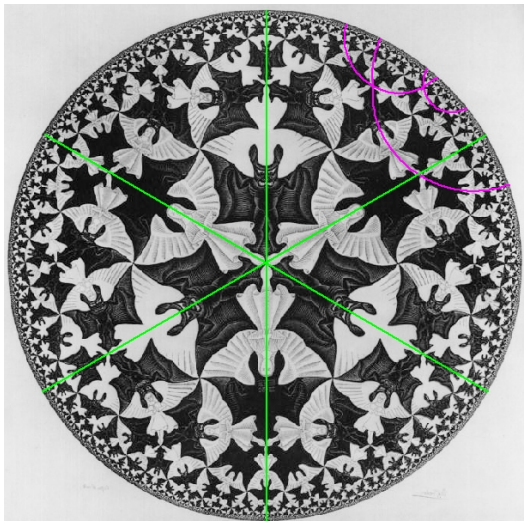


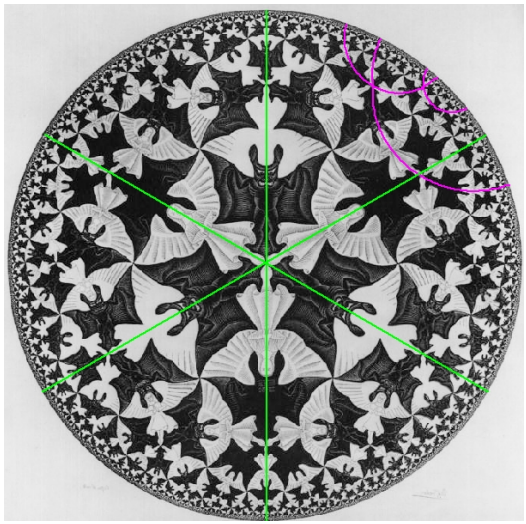
Dutch graphic artist M.C. Escher's Sphere Surface with Fish, 1958 and Circle Limit IV: Heaven and Hell, 1960;

Latvian/US mathematician Daina Taimina *Crocheting Adventures with Hyperbolic Planes*

Clicker Question

3. What are real-life applications of hyperbolic geometry?

a) modeling the internet to reduce the load on routers
b) modeling the folds of the brain and Mercury's orbit
c) building crystal structures to store more hydrogen or absorb more toxic metals
d) more than one of the above
e) none of the above



Latvian/US mathematician Daina Taimina *Crocheting Adventures with Hyperbolic Planes*

2D Worlds—Intrinsically and Extrinsically

Futurama: 2-D Blacktop

Living in a 2D World

The Geometry Center *The Shape of Space*

Flatland The Movie

4. What would Spherius say to the idea of more than three dimensions existing, do you think?

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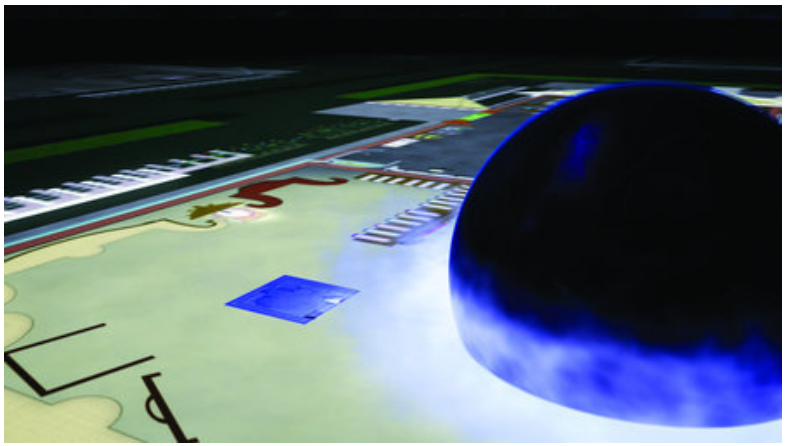
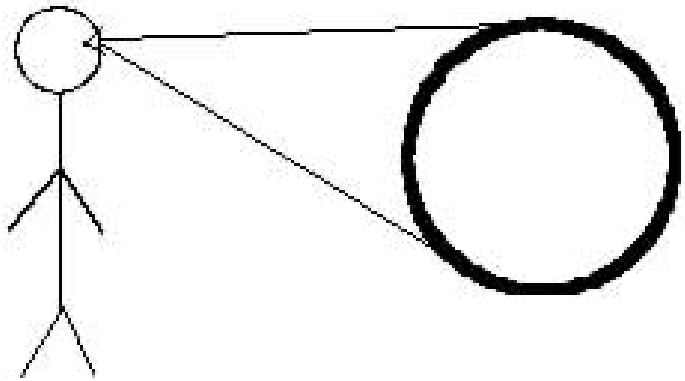


Flatland: The Movie



Experiencing Geometry by David Henderson and Daina Taimina

Davide Cervone, Tom Banchoff

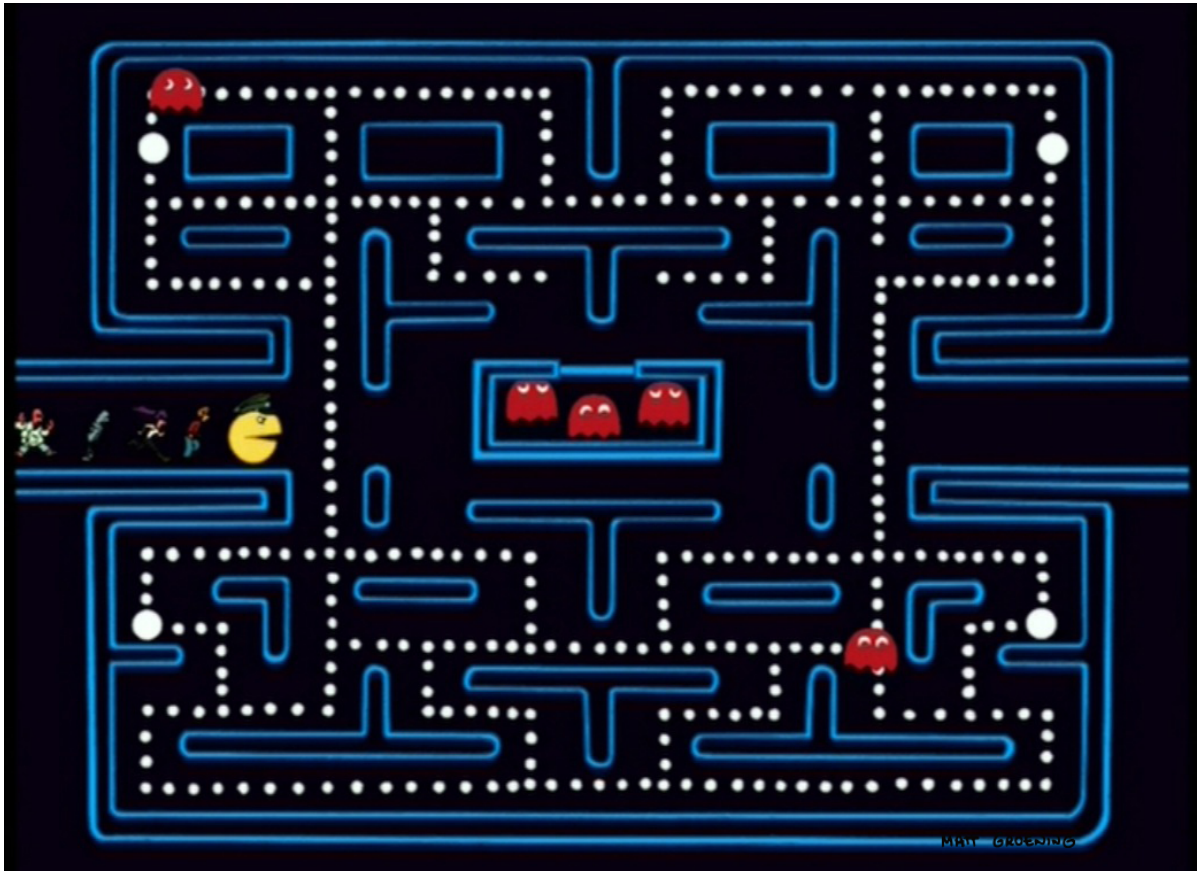
The Geometry of Pac-Man's Universe

Futurama: Anthology of Interest II

The Geometry of Pac-Man's Universe

Futurama: Anthology of Interest II

The Geometry of Pac-Man's Universe



Futurama: Anthology of Interest II

The Geometry of Pac-Man's Universe

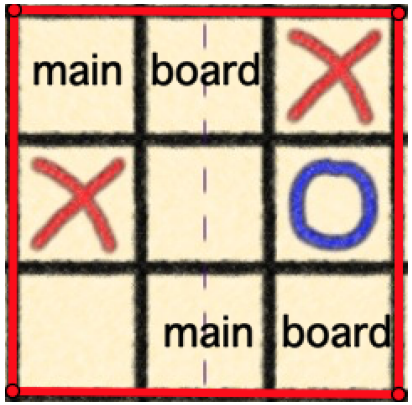
Futurama: Bender's Big Score

Shape of 2D Space—Wraparound Space

The Geometry Center: *The Shape of Space*

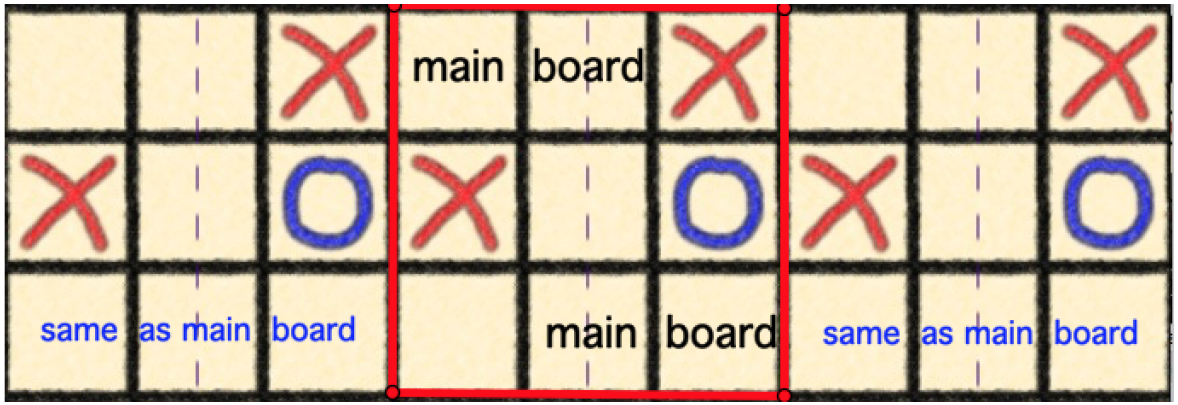
Shape of 2D Space—Wraparound Space

The Geometry Center: *The Shape of Space*
Jeff Weeks Torus Games



Shape of 2D Space—Wraparound Space?

The Geometry Center: The Shape of Space
Jeff Weeks Torus Games



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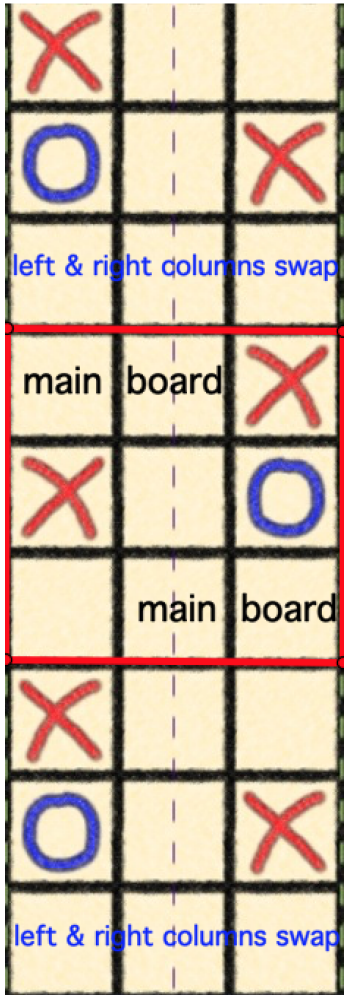
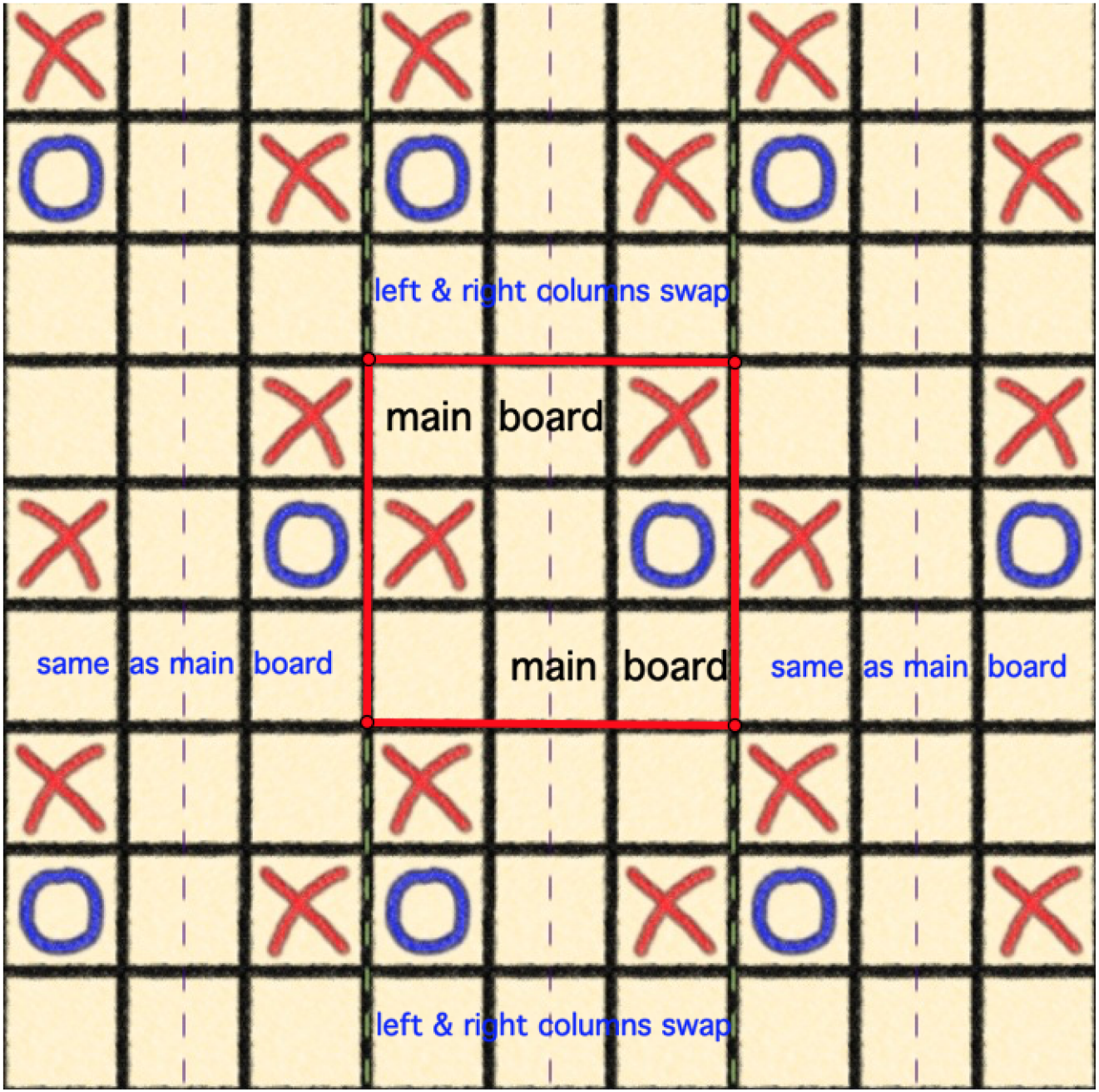
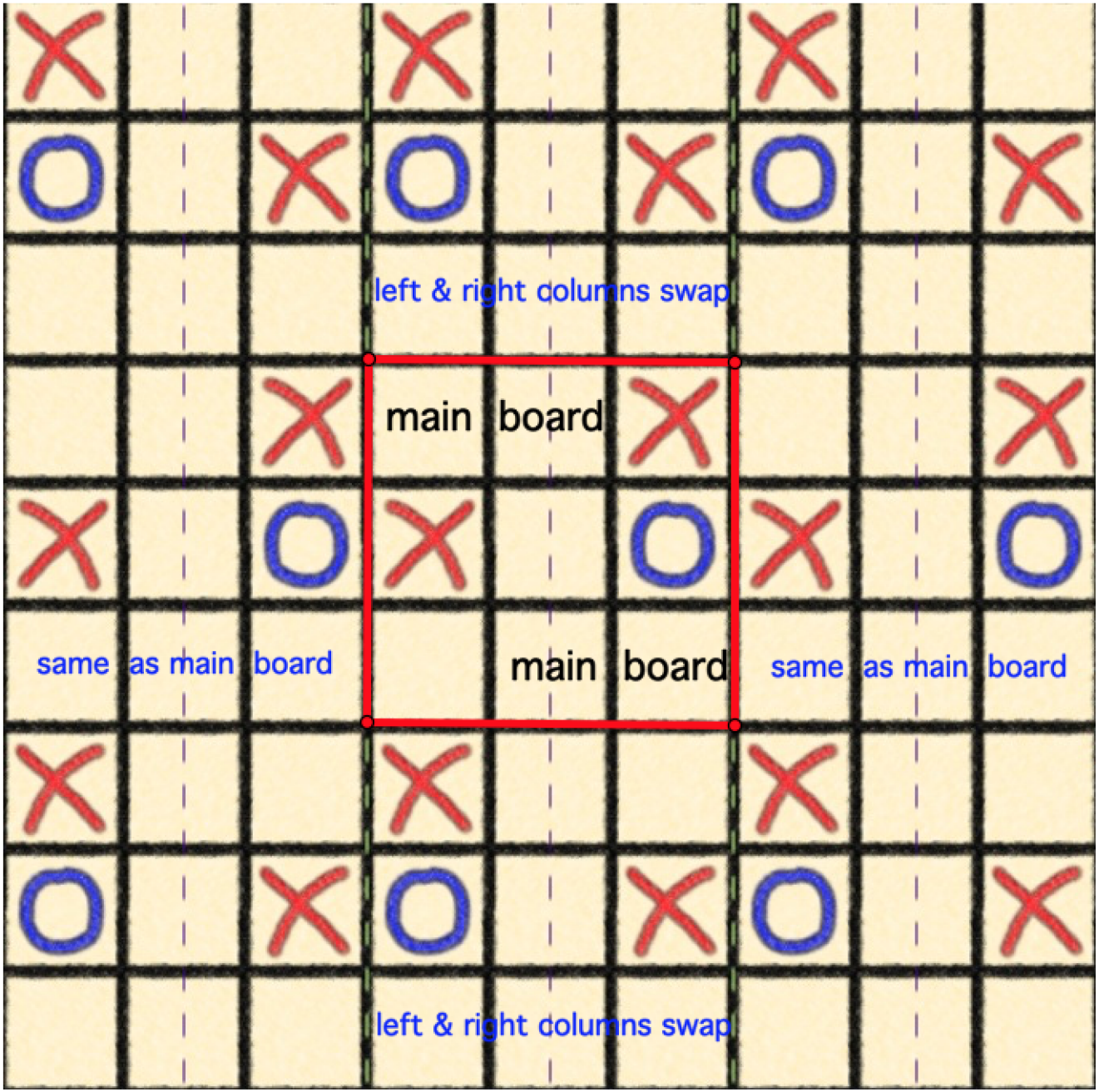



left & right columns swap
main board
same as main board
main board
same as main board
left & right columns swap



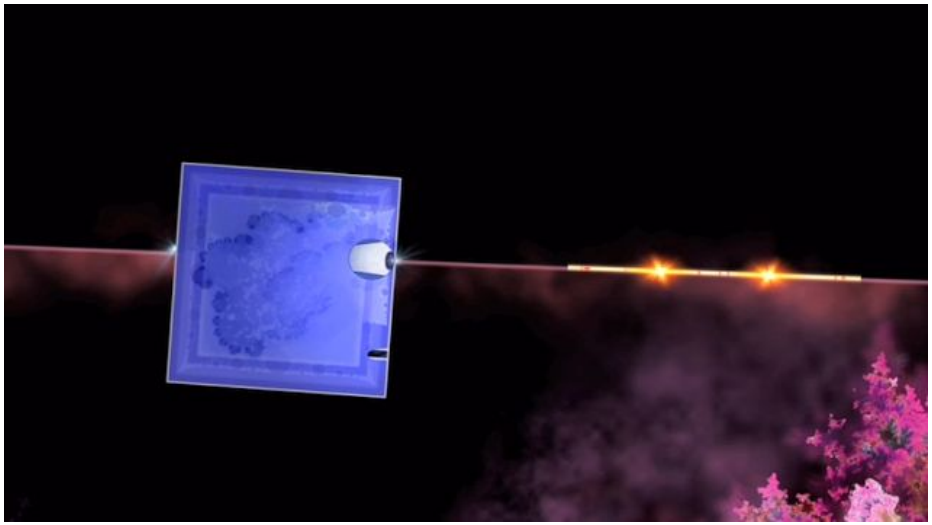
o has no chance of winning on this Klein bottle

5. In a wraparound universe, we can head off on a path that feels straight to us and eventually come back around. Which are wraparound?

a) Pac-Man's universe, a flat Euclidean torus
b) Klein bottle tic-tac-toe, a flat Euclidean Klein bottle
c) the infinite flat Euclidean plane
d) both a) and b)
e) all of the above

6. How many dimensions does lineland have in *Flatland the Movie*?

a) one and I have a good reason why
b) one but I am unsure of why
c) two but I am unsure of why
d) two and I have a good reason why
e) other



7. Which of the following could Arthur Square see at some point in time if a donut is dunked with the hole facing him? First think about what are cross sections in the 2D Flatland universe and then think about what would Arthur square could actually see (assume he can only see in the 2D universe)?

a) 

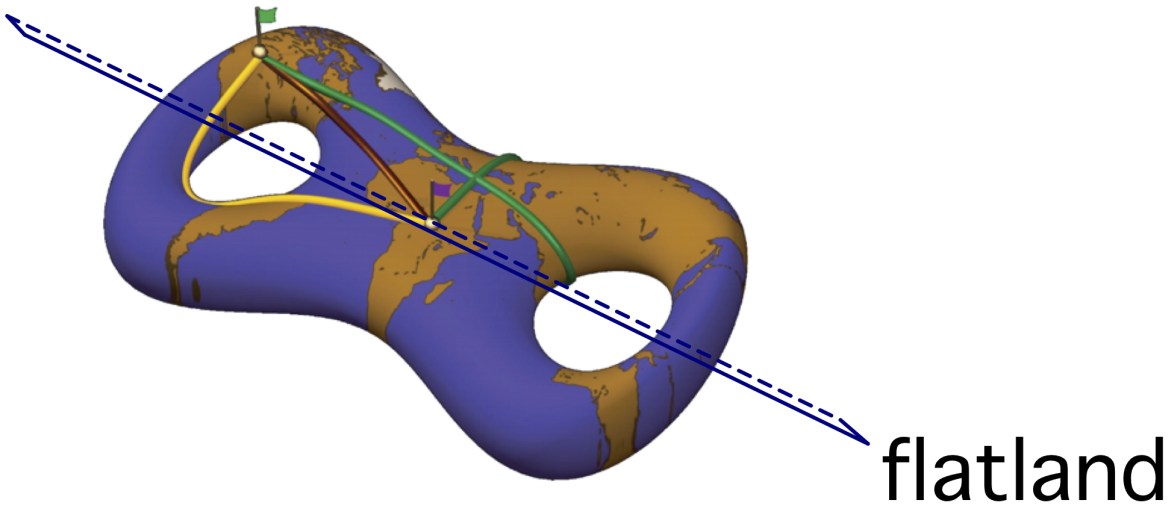
b) 

c) both

d) neither

8. A 2-holed donut arose in the 2D universe readings

a) Sketch what the full cross section would be when a 2-holed donut passes through Flatland, in a view that includes the two holes.



b) Sketch what Arthur square would see when a 2-holed donut passes by him in Flatland (assume that he can only see in the 2D universe), in a view that includes the two holes.

9. Play a game of Klein bottle tic-tac-toe: sketch the tiling view and label on the main board where *o* should go to block. Can *o* block a win from *x*?