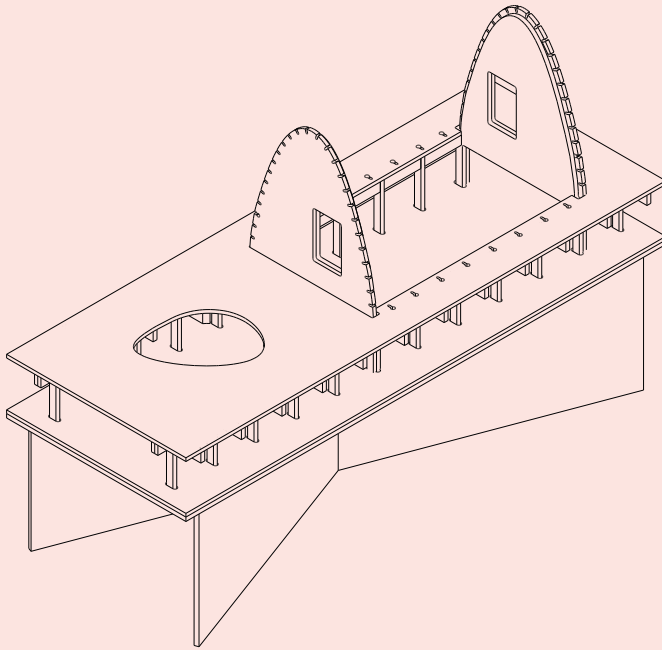


Ark



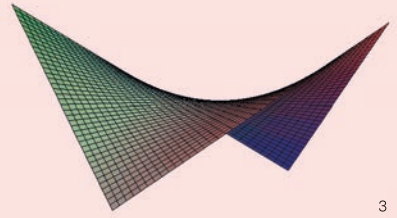
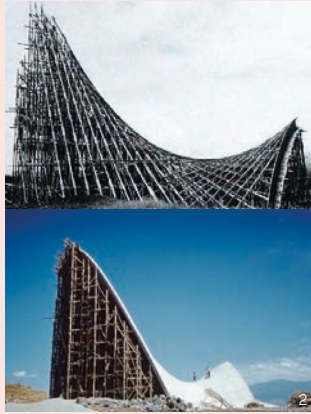
FR Cette maquette est l'Arche verte, un pavillon pour les visiteurs situé au milieu des serres de la collection de plantes du jardin botanique de Meise. De là, les visiteurs peuvent observer toutes les plantes dans leurs différents climats.

Les deux parois verticales du dôme sont des paraboles sur lesquels des fentes sont prévues. Reliez les chiffres de chaque côté avec un élastique : cela forme une ligne droite. Dans chaque fente, il y a deux extrémités. Toutes ces lignes droites forment une surface à double courbure. Il y a des lignes longues et courtes, utilisez des élastiques plus ou moins longs pour cela. C'est ainsi que l'on tisse le toit comme on l'a fait dans le pavillon avec de fines planches de bois. Avec de simples joints droits, on obtient cette forme compliquée : une hyperboloïde parabolique.

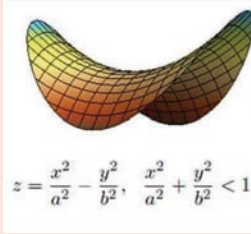
NL Deze maquette is de groene Ark, een bezoekerspaviljoen dat midden in de serres staat van de plantencollectie van de Plantentuin van Meise. Van hieruit kunnen de bezoekers al de planten in hun verschillende klimaten bekijken. De twee verticale kopgevels van de koepel zijn parabolen waarop gleufjes zijn voorzien. Verbind de getallen aan elke zijde met een

elastiekje: dat vormt een rechte lijn. In elk gleufje komen twee uiteinden. Al deze rechte lijnen vormen samen een dubbel gebogen oppervlak. Er zijn lange en kortere lijnen, gebruik daarvoor langere en kortere elastieken. Zo weef je het dak zoals men dat in het paviljoen met dunne houten planken heeft gedaan. Met eenvoudige rechte verbindingen maak je zo deze ingewikkelde vorm: een regeloppervlak of een parabolische hyperboloïde.

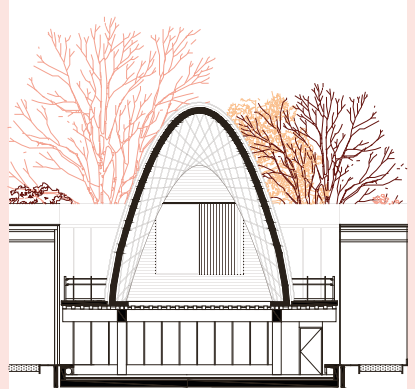
EN This model is the Green Ark, a visitor's pavilion located in the middle of the greenhouses of the plant collection of the Meise Botanical Garden. From here, visitors can view all the plants in their various climates. The two vertical end walls of the dome are parabolas on which slots are provided. Connect the numbers on each side with a rubber band: this forms a straight line. In each slit come two ends. All these straight lines together form a double curved surface. There are long and shorter lines, use longer and shorter rubber bands for that. This is how you weave the roof as one did in the pavilion with thin wooden planks. With simple straight connections, this is how you make this complicated shape: a parabolic hyperboloid.



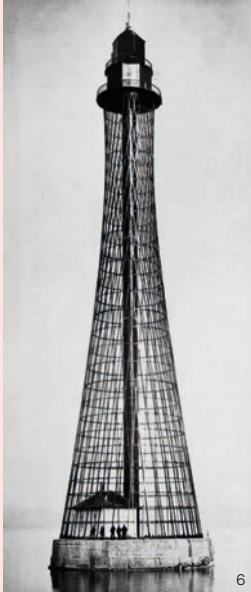
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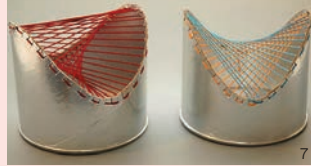
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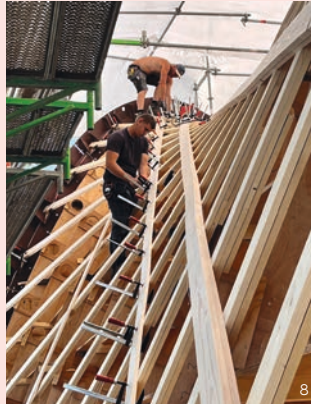
5



6



7



8



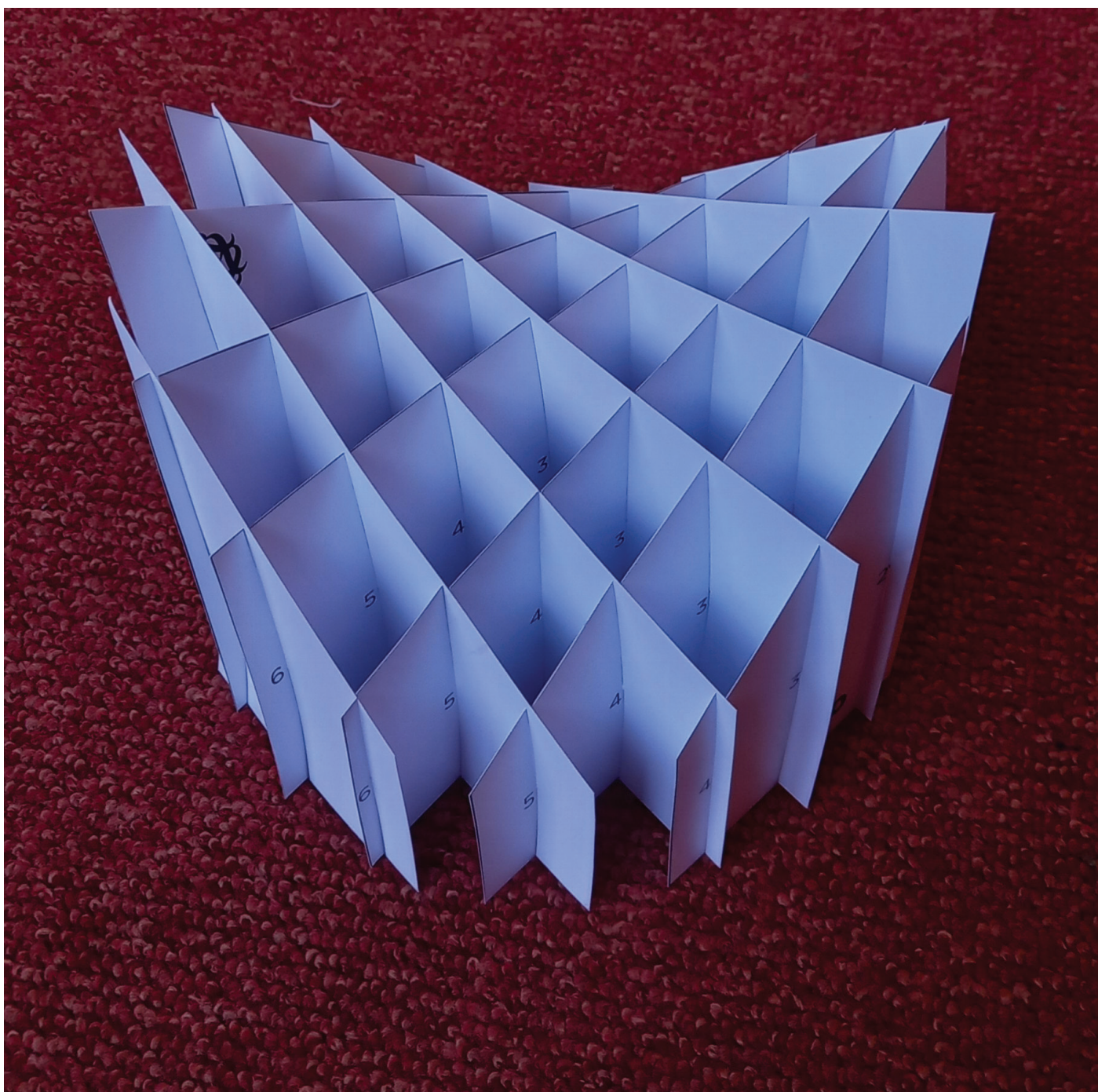
9

1 Squelette d'un cactus / skelet van een cactus / skeleton of a cactus 2 Capilla de Cuernavaca, Félix Candela 3 Hyperbolic Paraboloid 4 Ingénierie hyperbolique des chips Pringles / Hyperbolische engineering van Pringles chips / Hyperbolic engineering of Pringles chips 5 De Groene ARK, Agentschap Plantentuin Meise, section / snede © NU architectuuratelier 6 Adziogol phare / vuurtoren / lighthouse, Vladimir Shukhov 7 model 8-9 De Groene ARK, Agentschap Plantentuin Meise, construction site / werf / © Stijn Bollaert © Tim Van Verdegheem

EN Below some informations, ideas and templates to make a parabolic hyperboloïde in paper for yourself.

NL Hieronder wat informatie, ideeën en sjablonen om zelf een parabolische hyperboloïde in papier te maken.

FR Ci-dessous quelques informations, idées et modèles pour réaliser vous-même un hyperboloïde parabolique en papier.



Hyperbolic Paraboloid, Sheet 1a

1. Cut out all the parts of both sheets on the outside lines.
2. Cut each slit twice, once on the left side of its printed line and once on the right side of its line. The slit itself can then be pulled off, leaving a space wide enough for another sheet of paper to fit. (You will want to try making only one cut per slit, but trust us, that won't work!)
3. Assemble in numerical order, with all the downward slit pieces as one set of parallel planes and all the upward slit pieces as the other set of parallel planes (see Figure 1). HINT: If you start by matching up the two sides of the small black logo (on the two **5** panels), you may find it easier to continue assembling from there.
4. Be sure to notice how it folds flat in two ways.

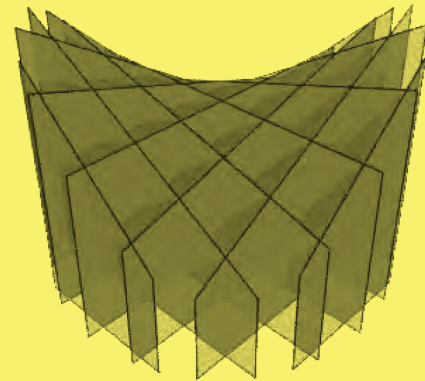
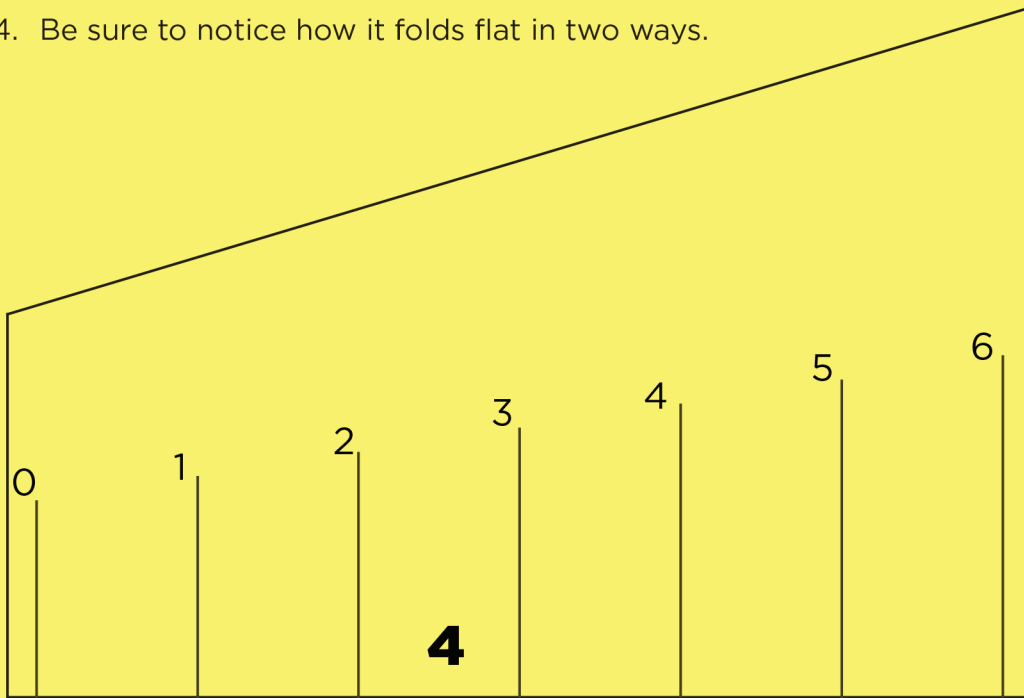
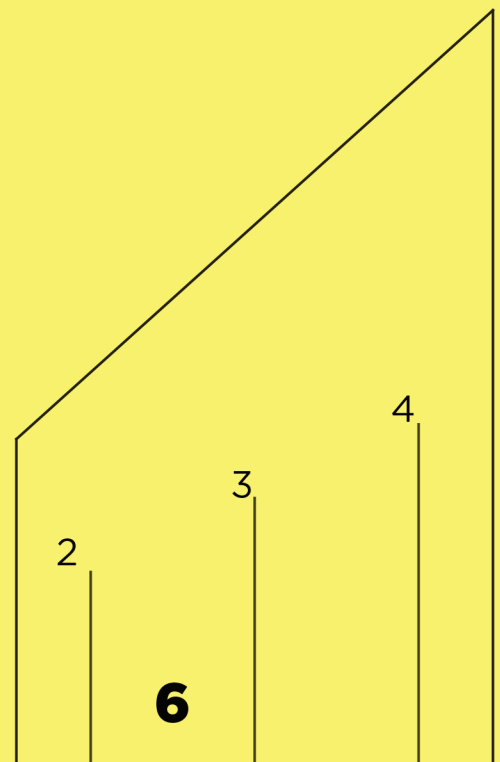
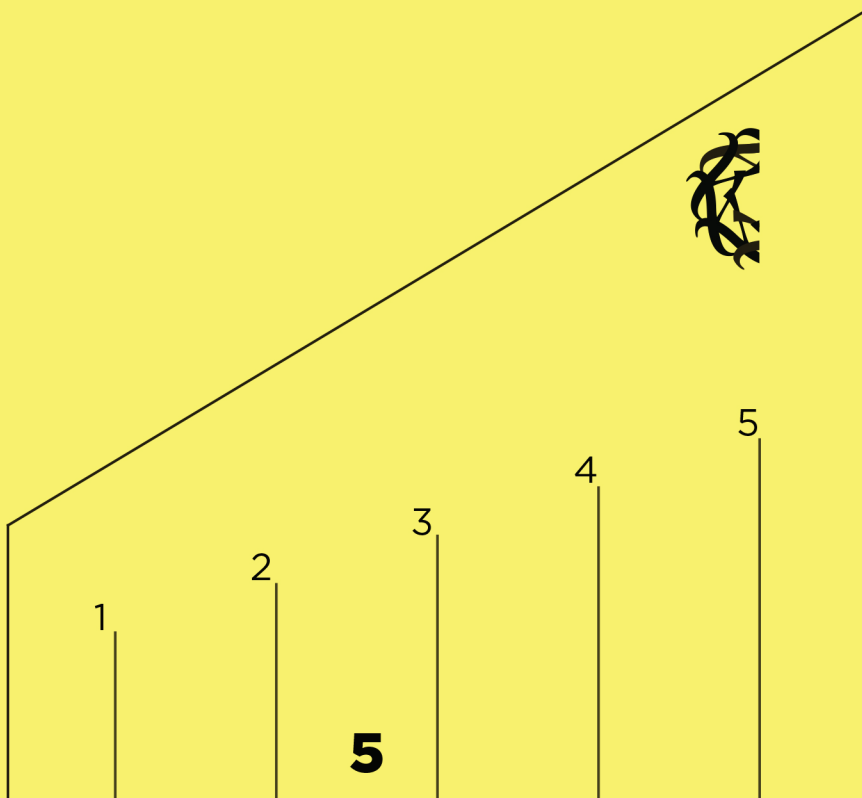
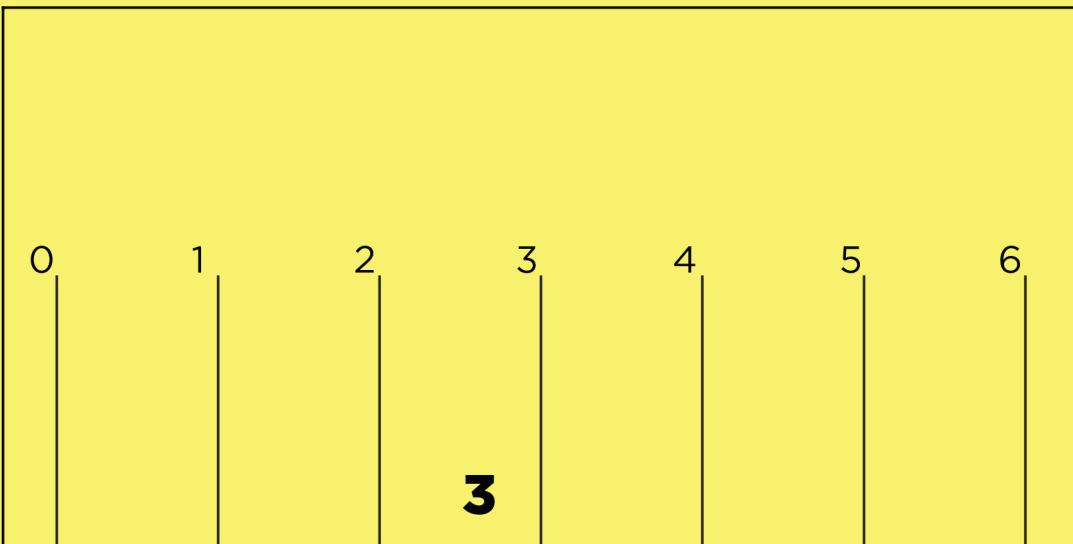
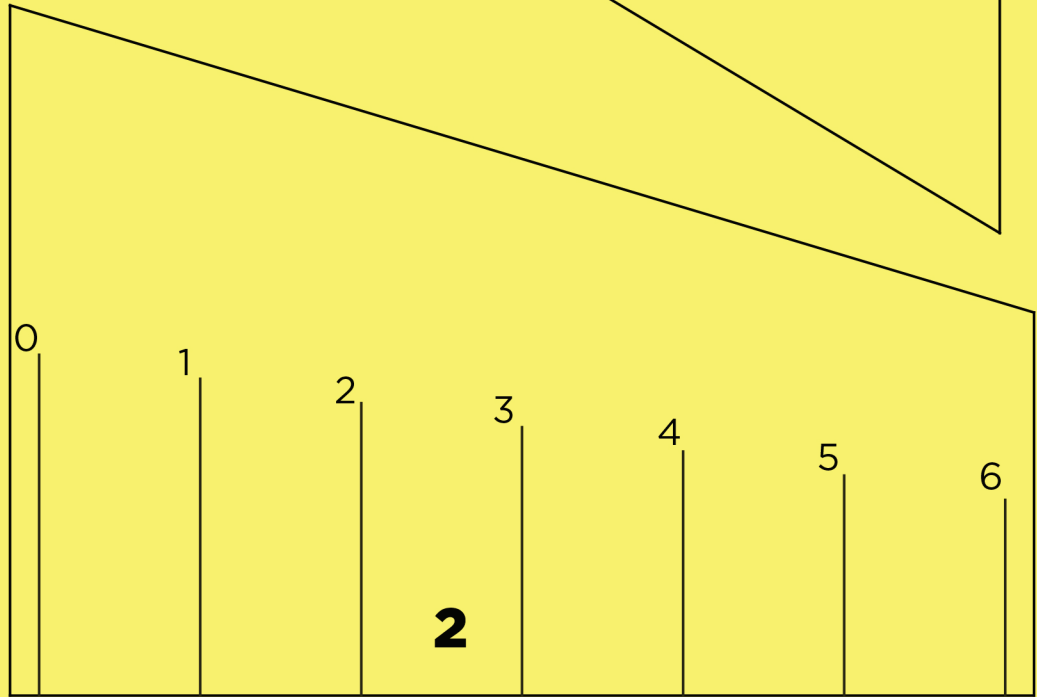
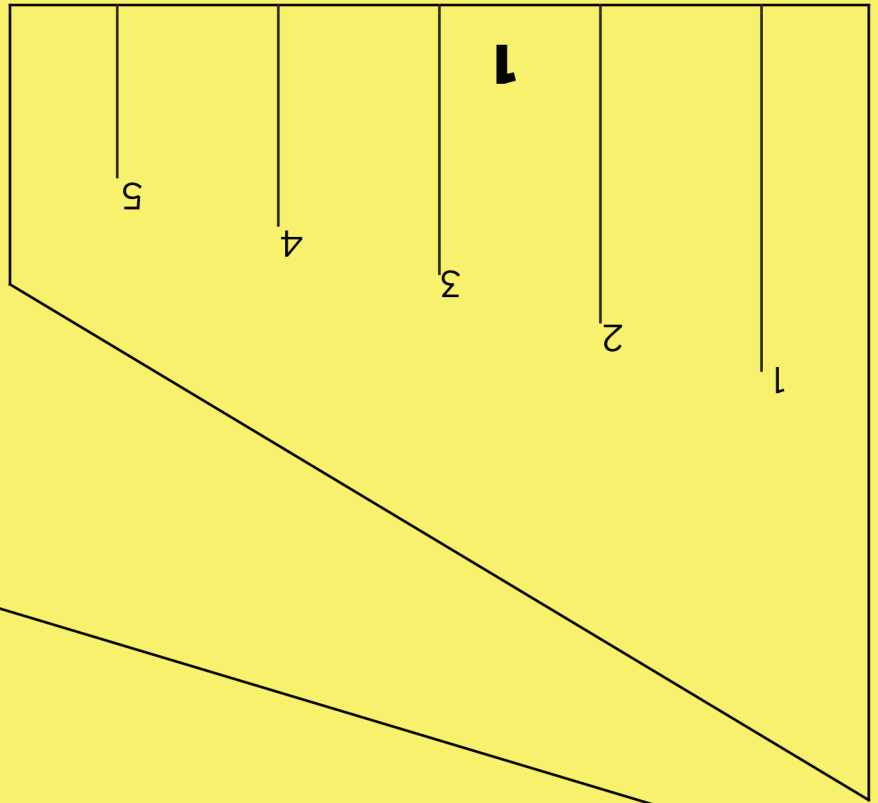
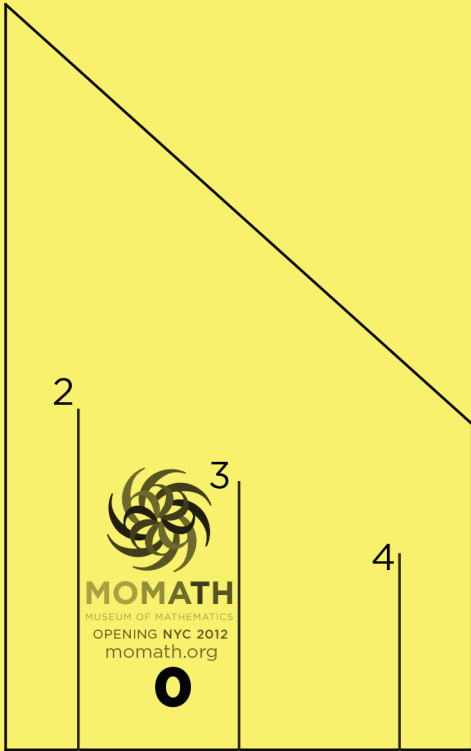


Figure 1.



Backside 1a



Backside 1b

Hyperbolic Paraboloid, Sheet 2a

Template to print on
220g paper

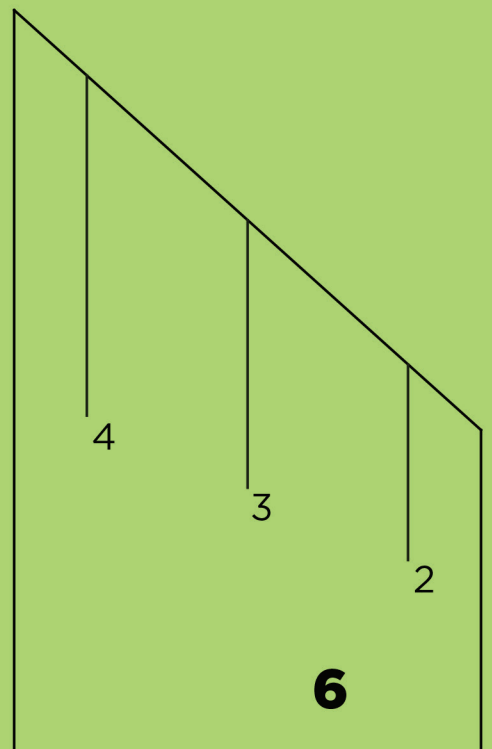
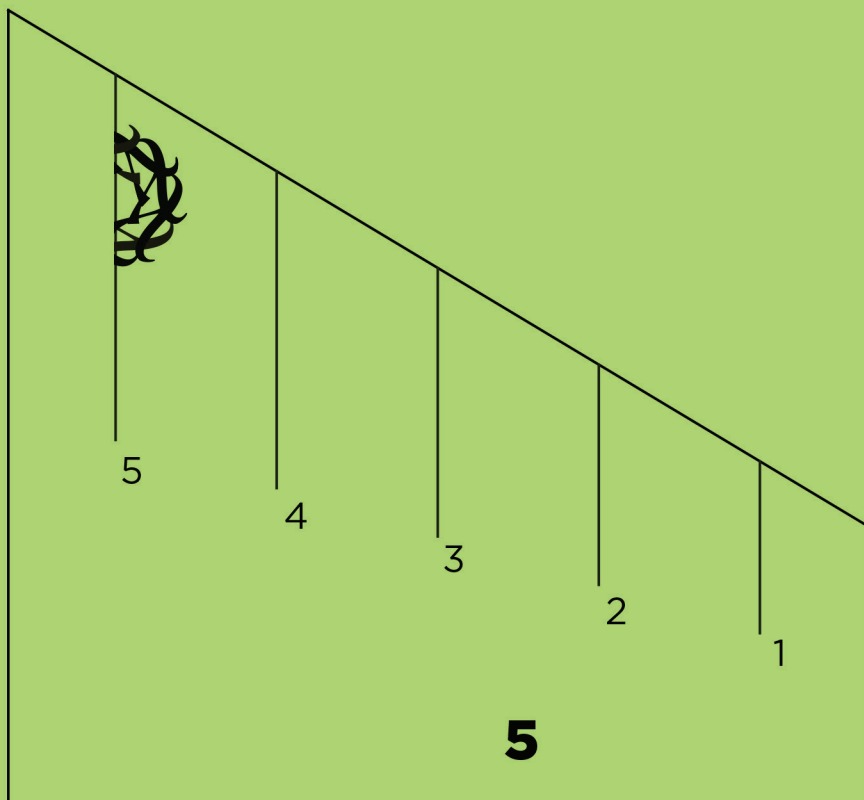
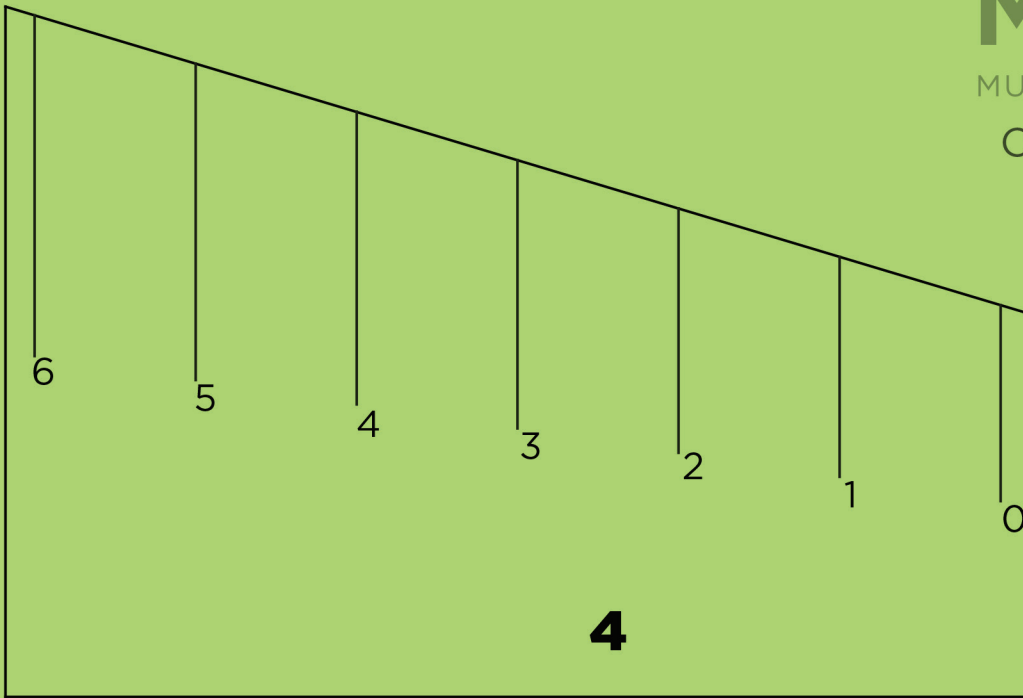


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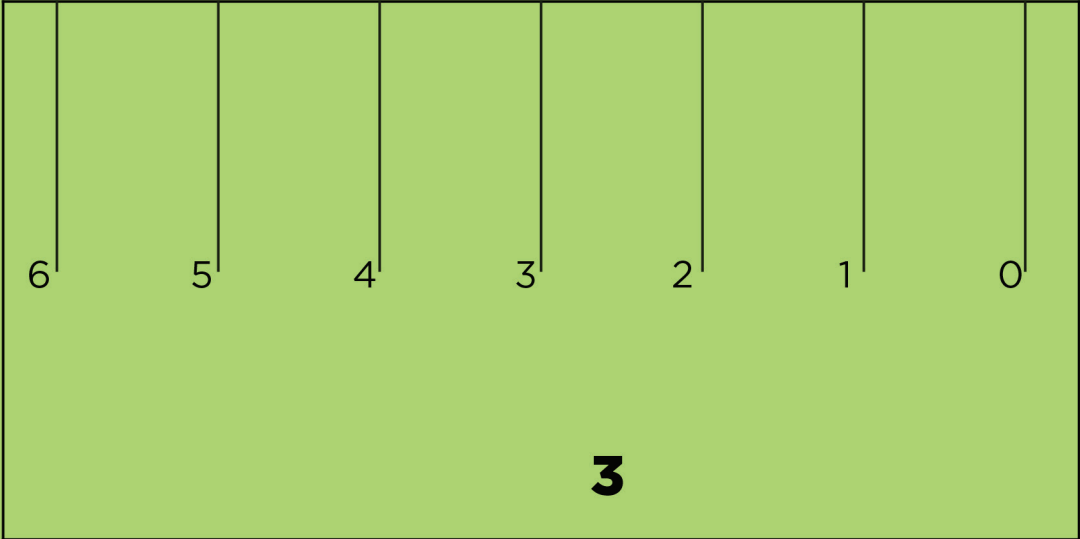
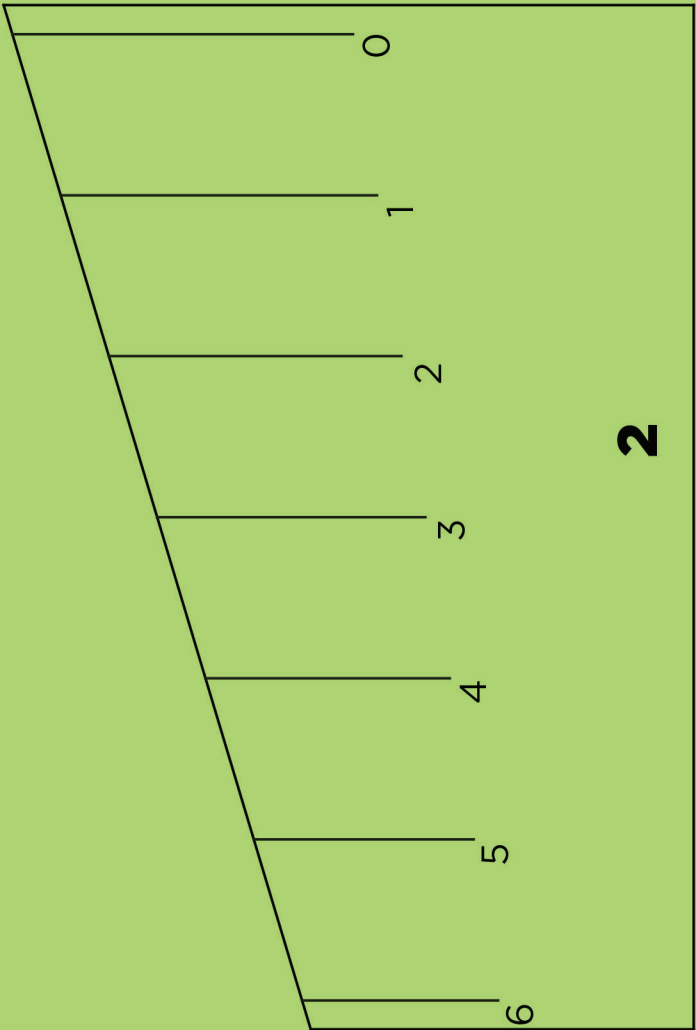
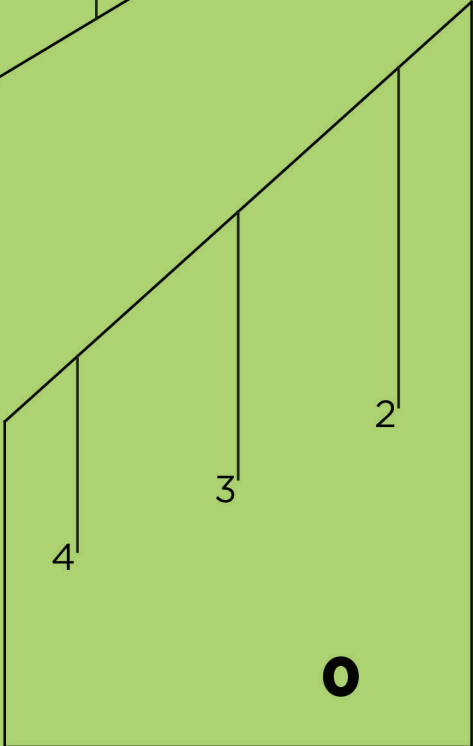
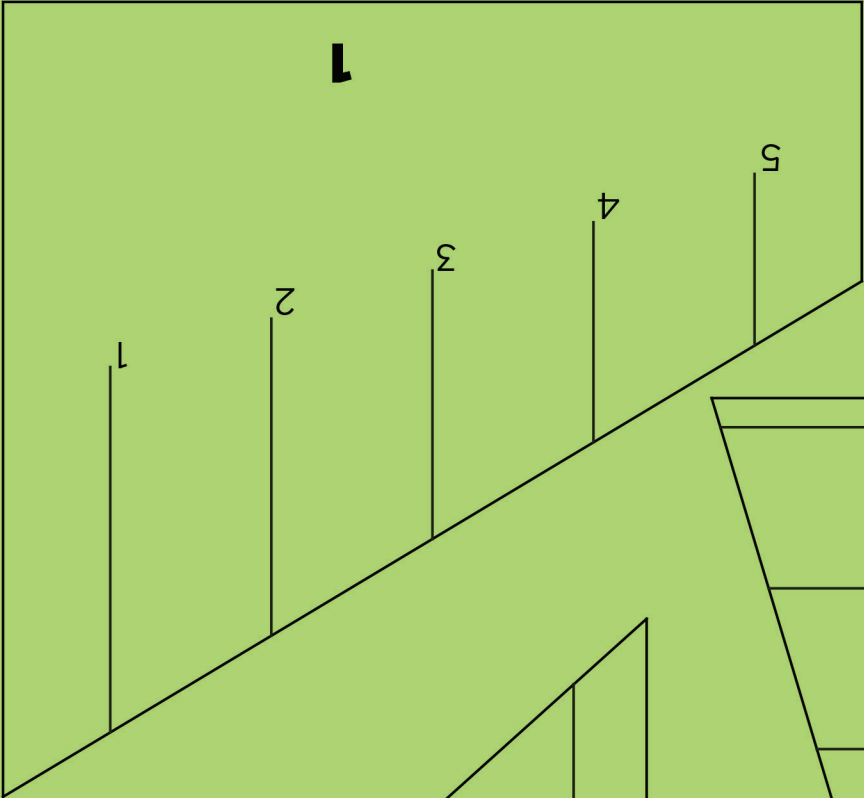
momath.org



Backside 2a

Hyperbolic Paraboloid, Sheet 2b

Template to print on
220g paper



Backside 2b

Materials and Tools

Cardstock (4 sheets)

Template

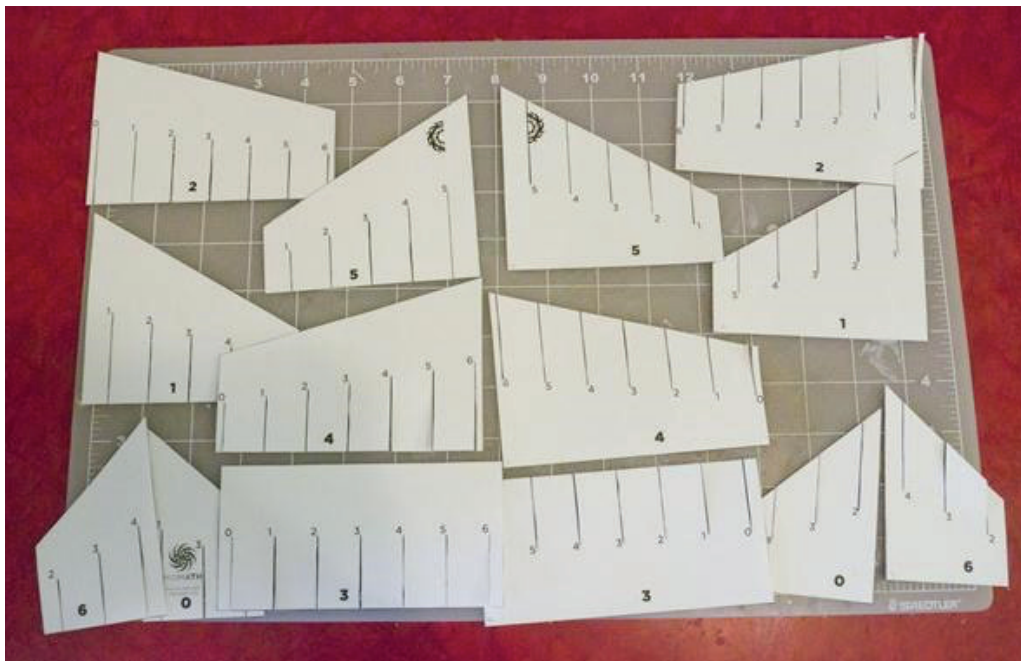
X-Acto knife (scissors might be possible, but very difficult)

Step 1 Download the Template and Print It Out

Download the template. Print it out onto 4 sheets of cardstock. If you have two different colors of cardstock, print out the first two pages on one color and the second two pages on a different color.

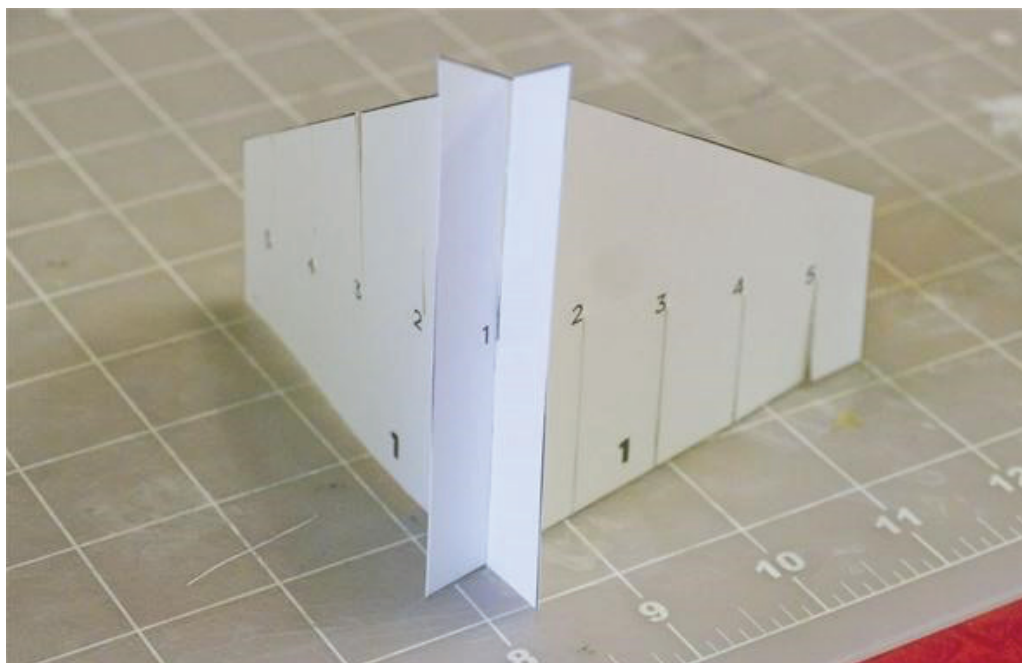
Step 2 Cut Out the Template

Cut the slits out first. You need to cut each slit twice, once on the left side and once on the right. You must cut on both sides, otherwise there will not be enough space to slide the two pieces together. After you cut both sides of the slits, cut out all of the pieces. You can now remove the slits by pulling on them. Note that there are two pieces of each number. On one of them the slits are on the bottom, and on the other the slits are on the top.

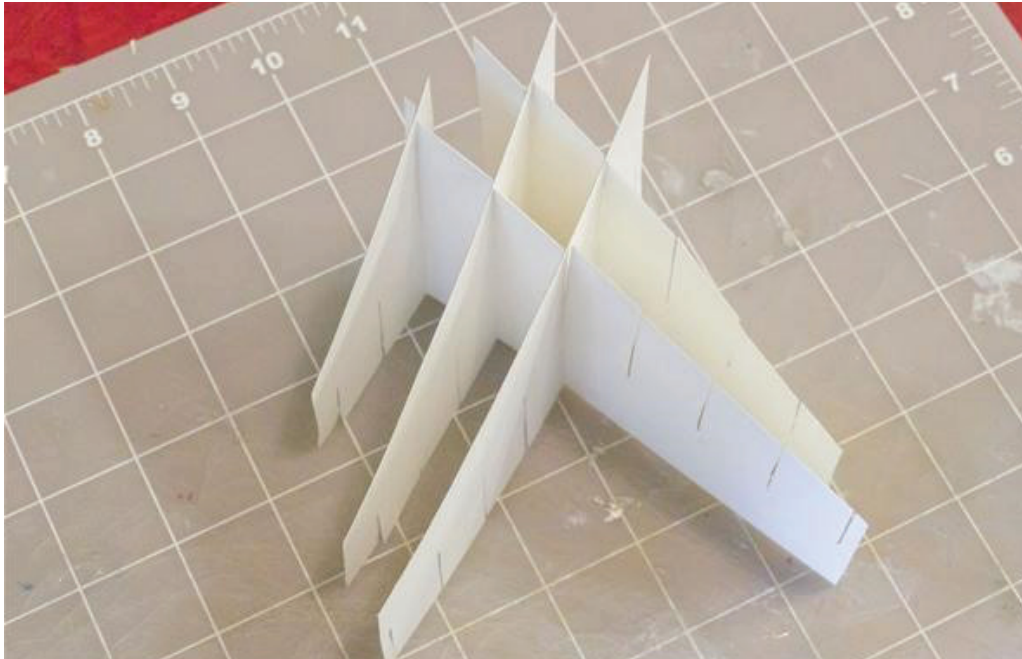


Step 3 Assemble

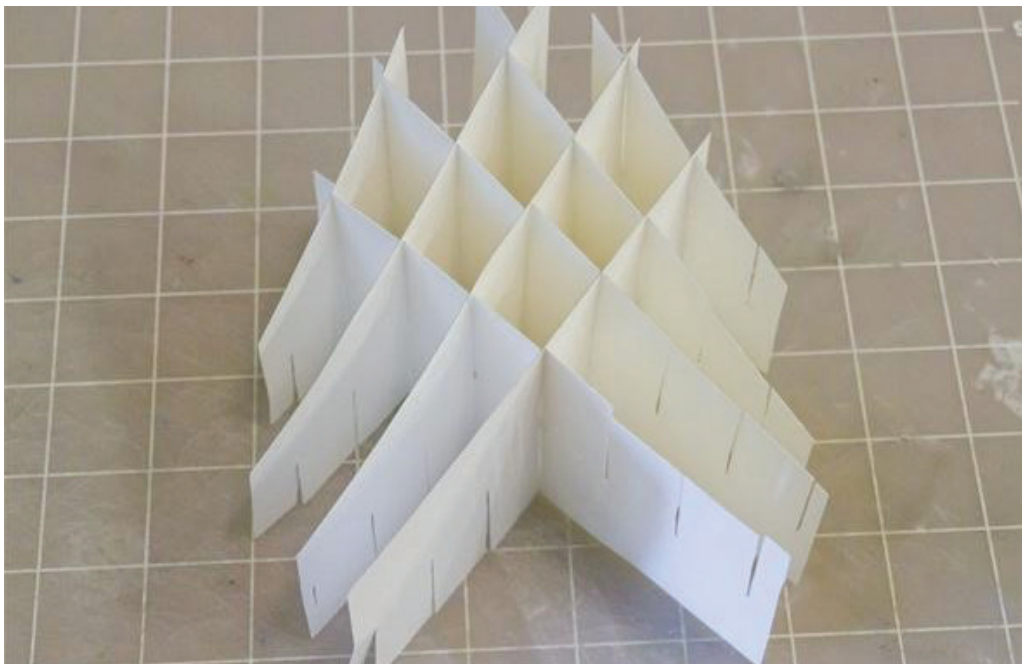
The pieces have been numbered to make assembly easy. Put the two pieces marked 1 together by lining up their 1 slots and sliding them into each other.



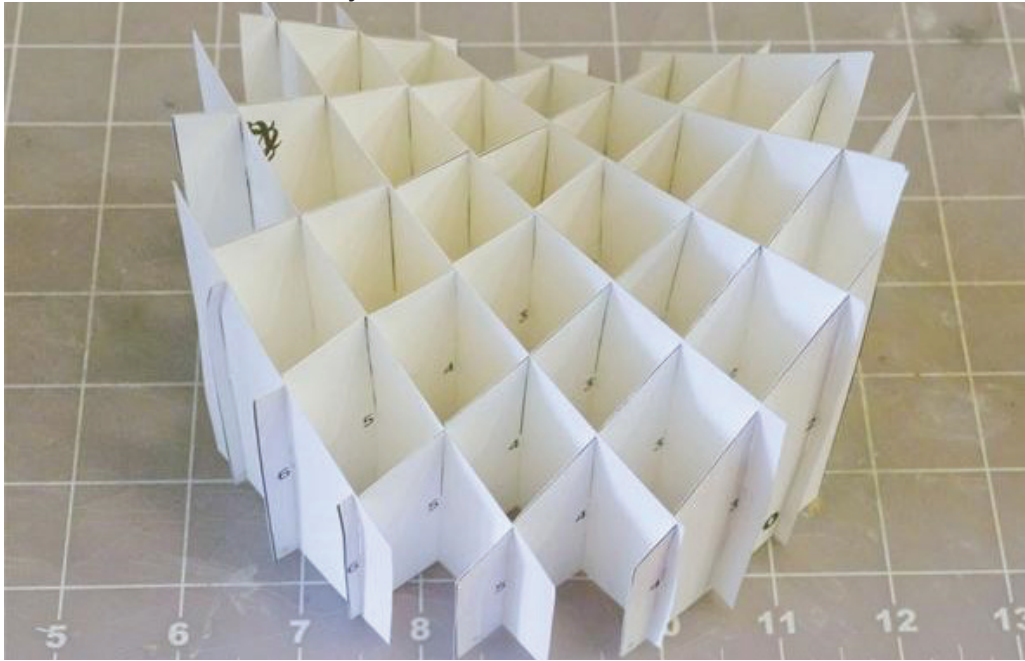
Now take one of the pieces marked 2 and slide it into the 2 slot of the 1 piece. Then take the other 2 piece and slide it into both the 2 slot of the other 1 piece and the 2 slot of the other 2 piece. You should now be able to add both of the 0 pieces by sliding them into the 0 slots on the 2 pieces.



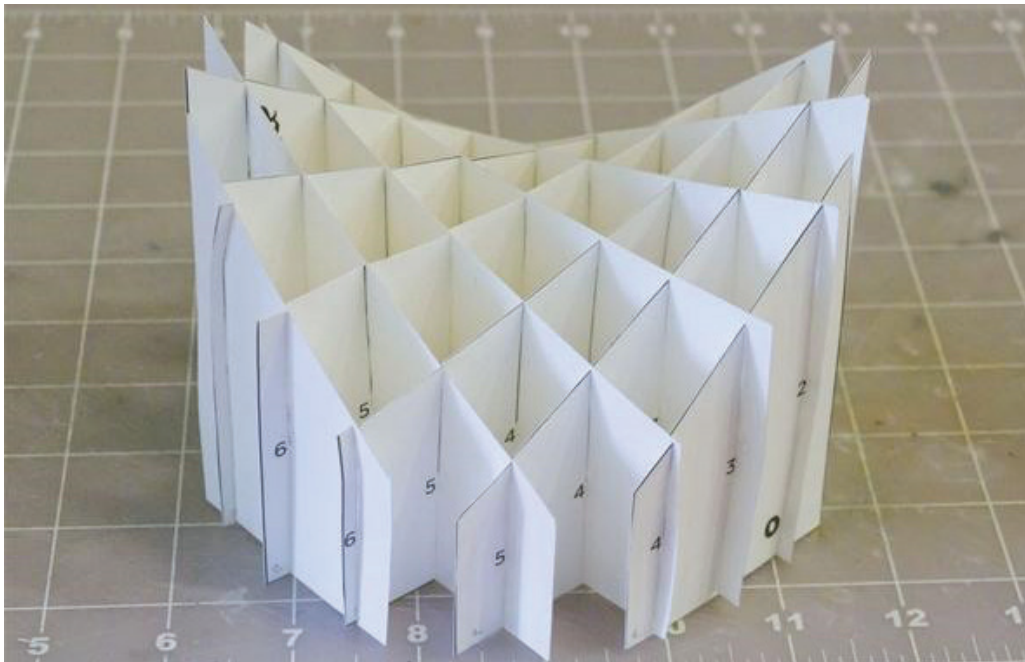
Continue by adding the 3 pieces.



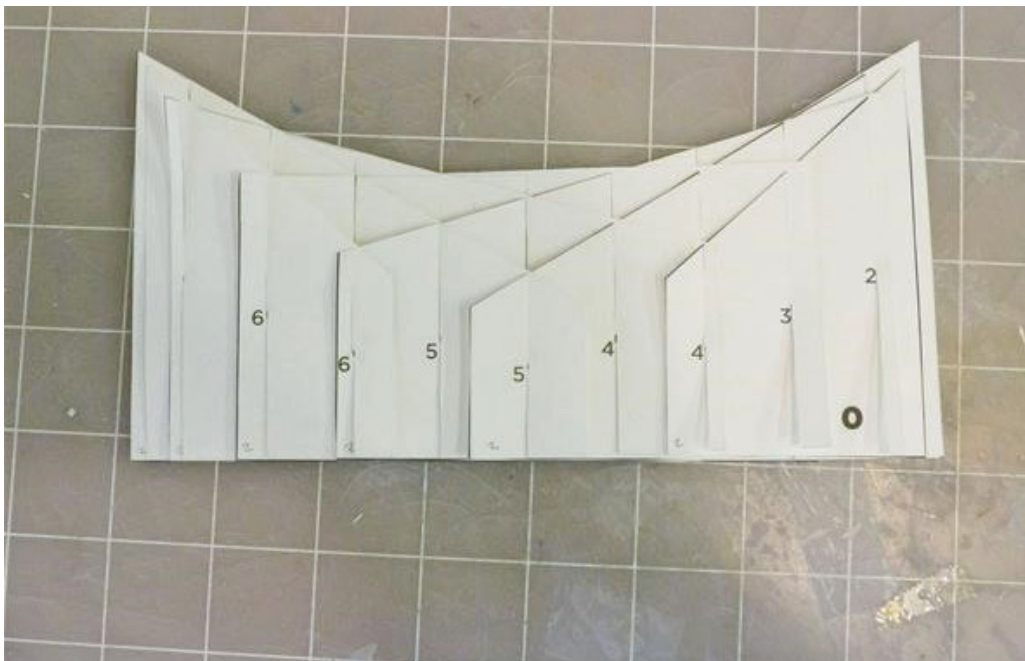
Here's what it should look like when you're finished.



From this angle you can really see the parabolic curvature of the piece.



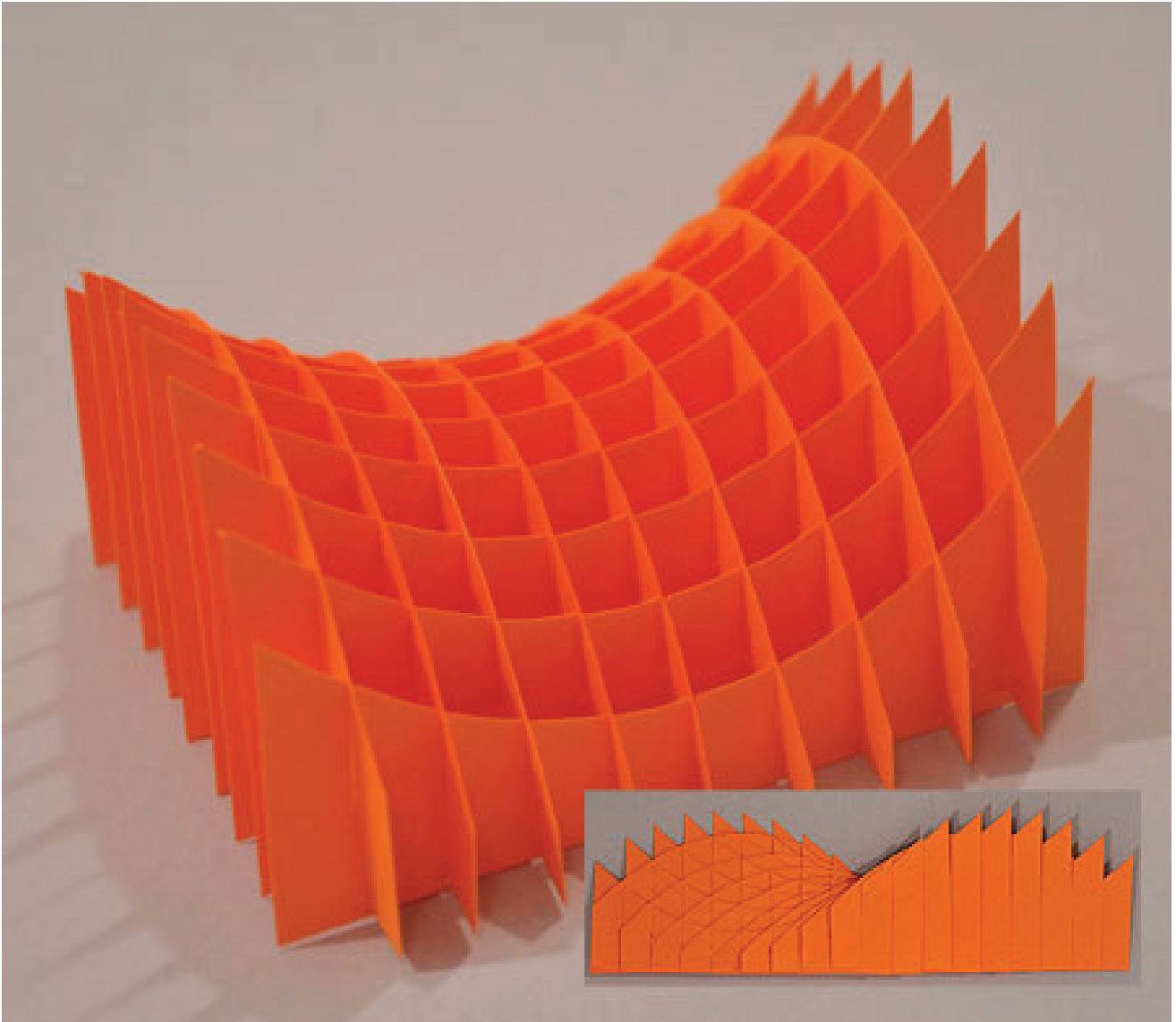
It folds completely flat in two different directions.



If you color the pieces, it looks good to color the pieces differently depending on the direction they go. Color the pieces that have bottom slots (first two pages) differently than the ones that have top slots (last two pages). I didn't have two colors of card stock, so I just used two felt tip markers.



Hyperbolic Paraboloid from Parabolic Cross Sections



<https://www.cutoutfoldup.com/972-hyperbolic-paraboloid-from-parabolic-cross-sections.php>

The graceful surface of a hyperbolic paraboloid comes across in this model. It is easy to see the two sets of parabolas that make up the curve. (The hyperbolas are harder to see!) The model flexes and can even fold flat.

Steps

Cut out the pattern pieces from card stock.

Cut out a narrow slot along each line. You should try to remove a narrow strip of material at each slot. If you don't, it will be harder to put the model together, the cross sections will warp and the model won't flex easily.

Slip the first two pieces from the pattern together at their middle slots.

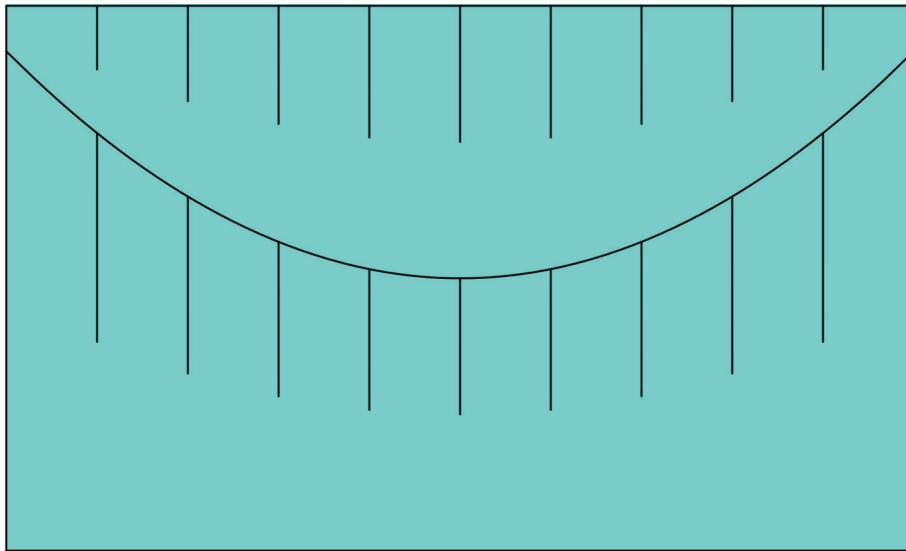
Assemble the rest of the pieces working from the middle of the model outward.

Notes

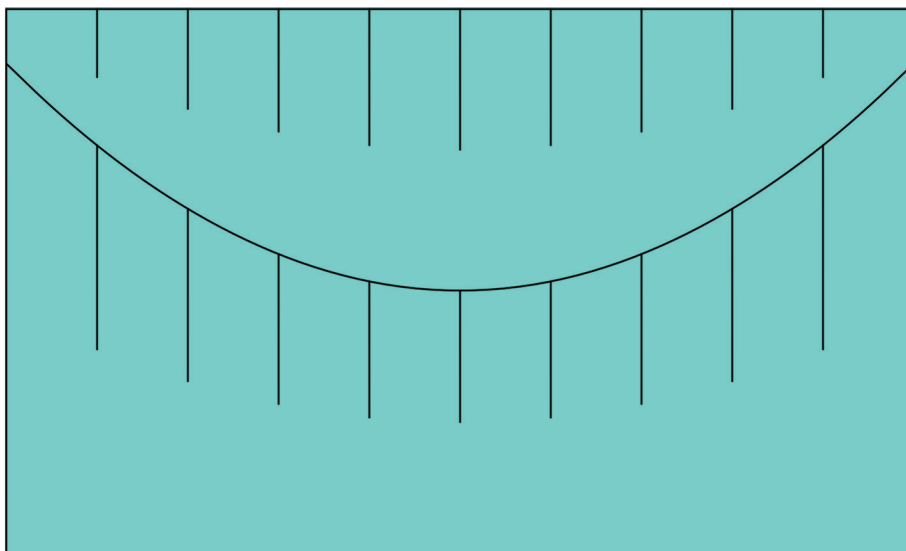
Each cross section uses the same parabola shifted up or down.

Hyperbolic Paraboloid from Cross Sections

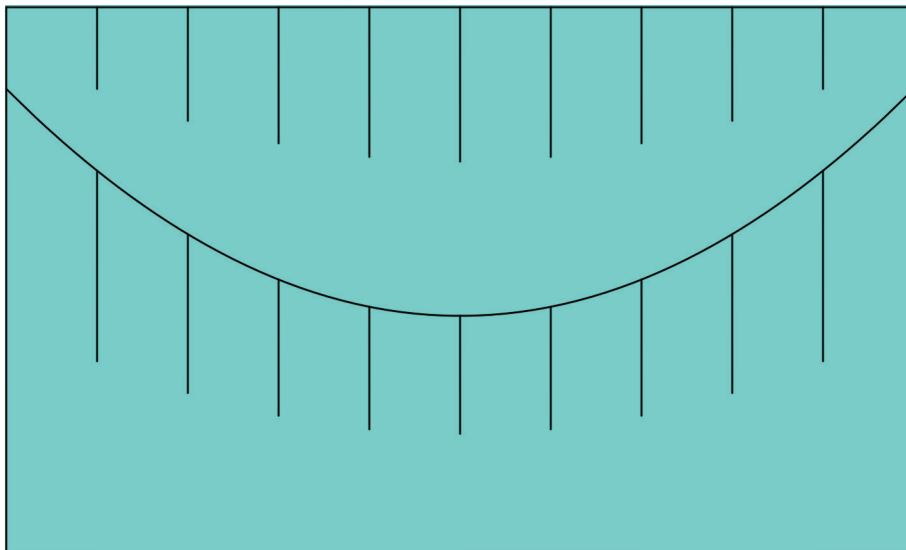
1 ×



2 ×

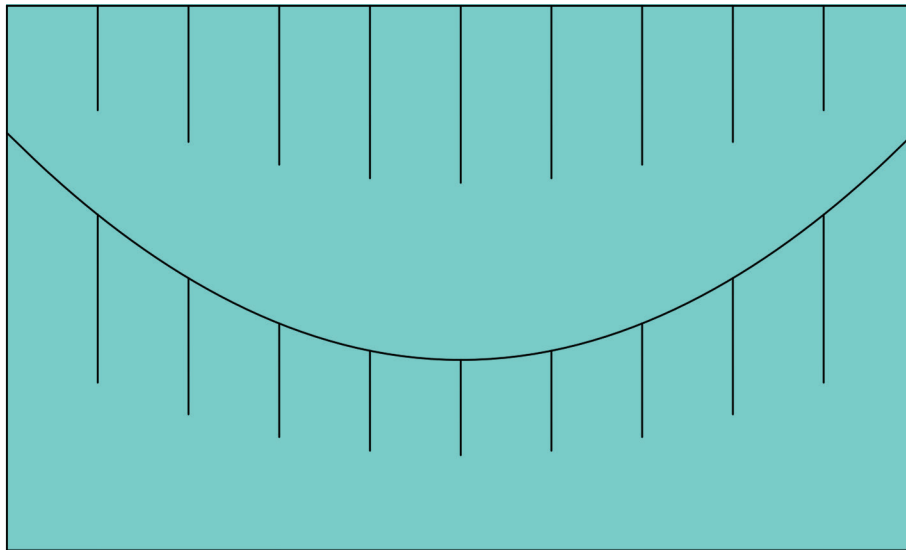


2 ×

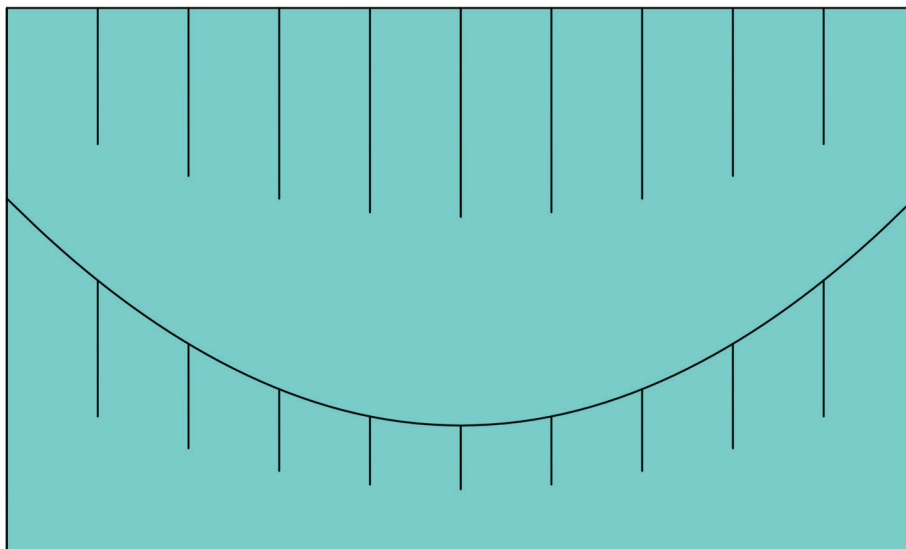


Backside

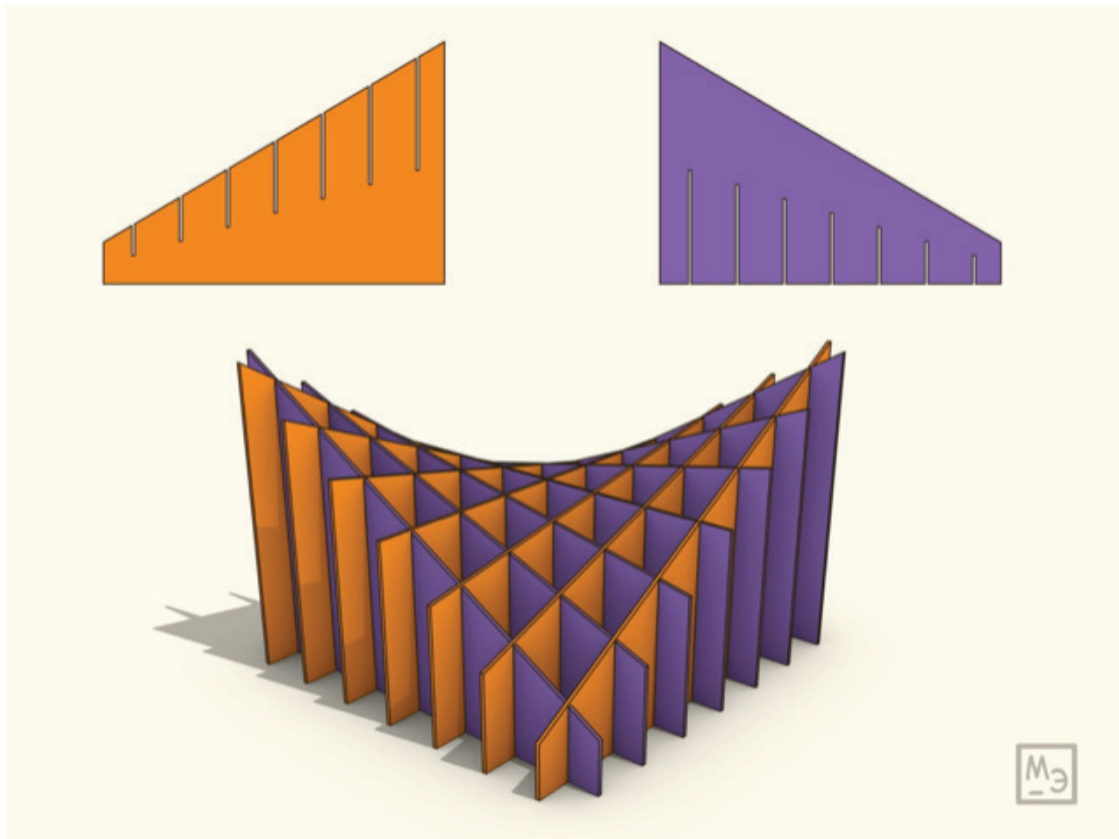
2 ×



2 ×

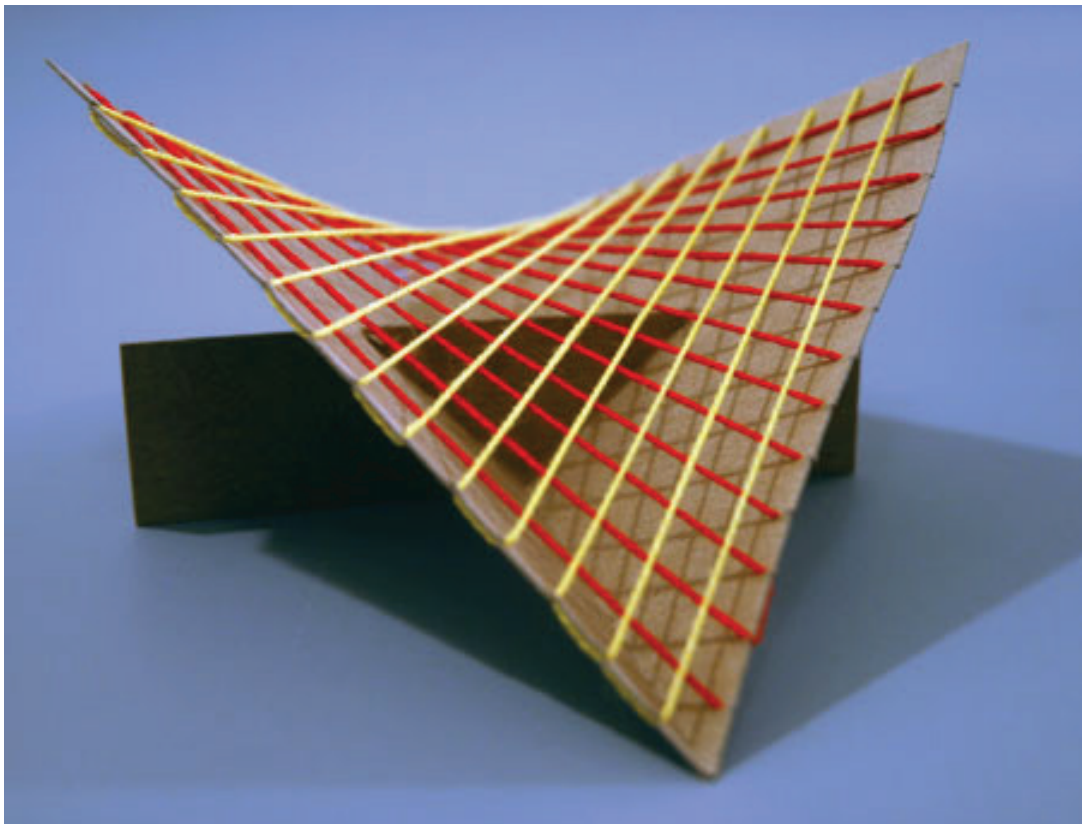


Backside

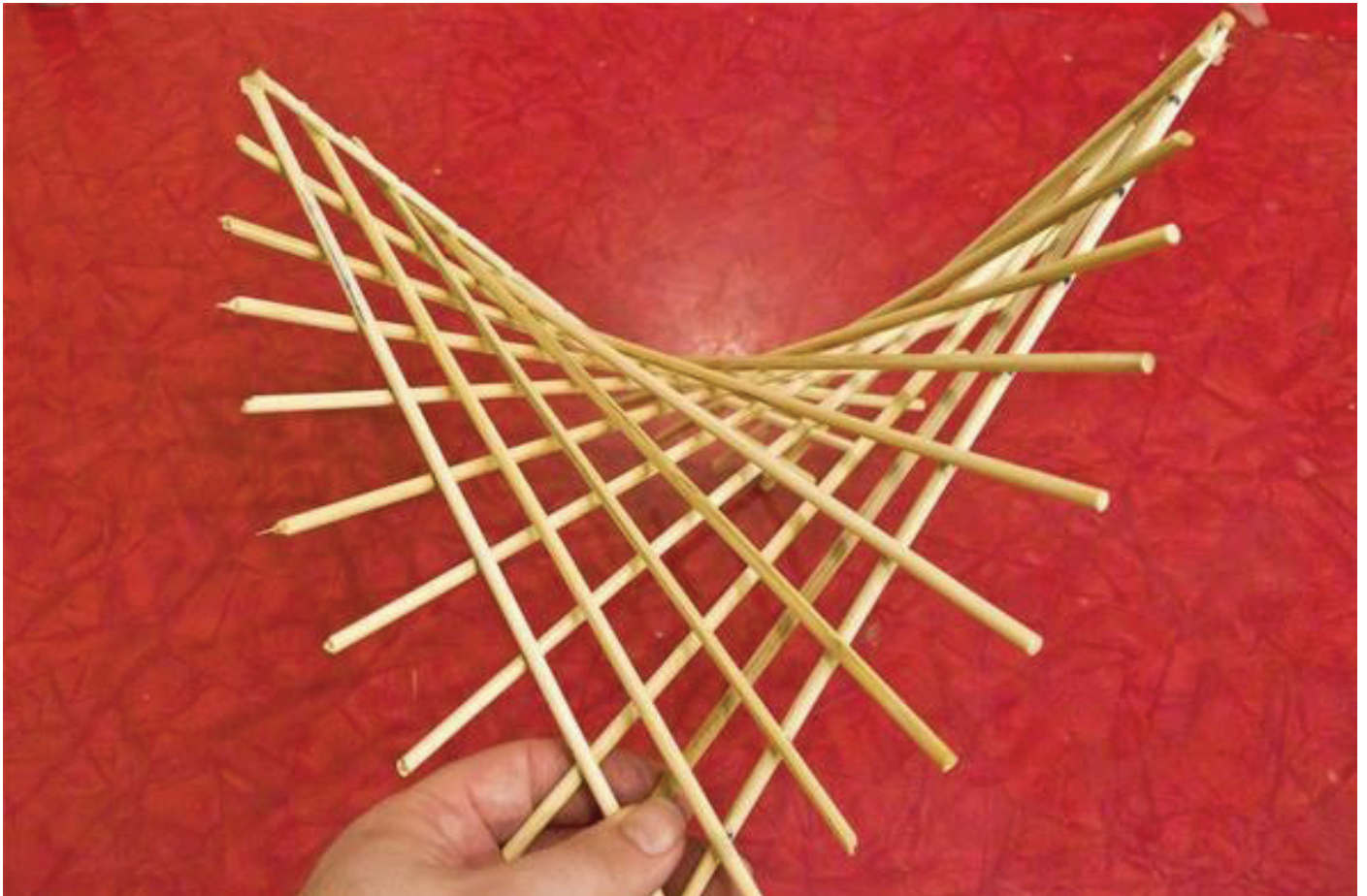


MATHCRAFT.WONDERHOWTO

<https://mathcraft.wonderhowto.com/how-to/make-hyperbolic-paraboloid-using-skewers-0131751/>

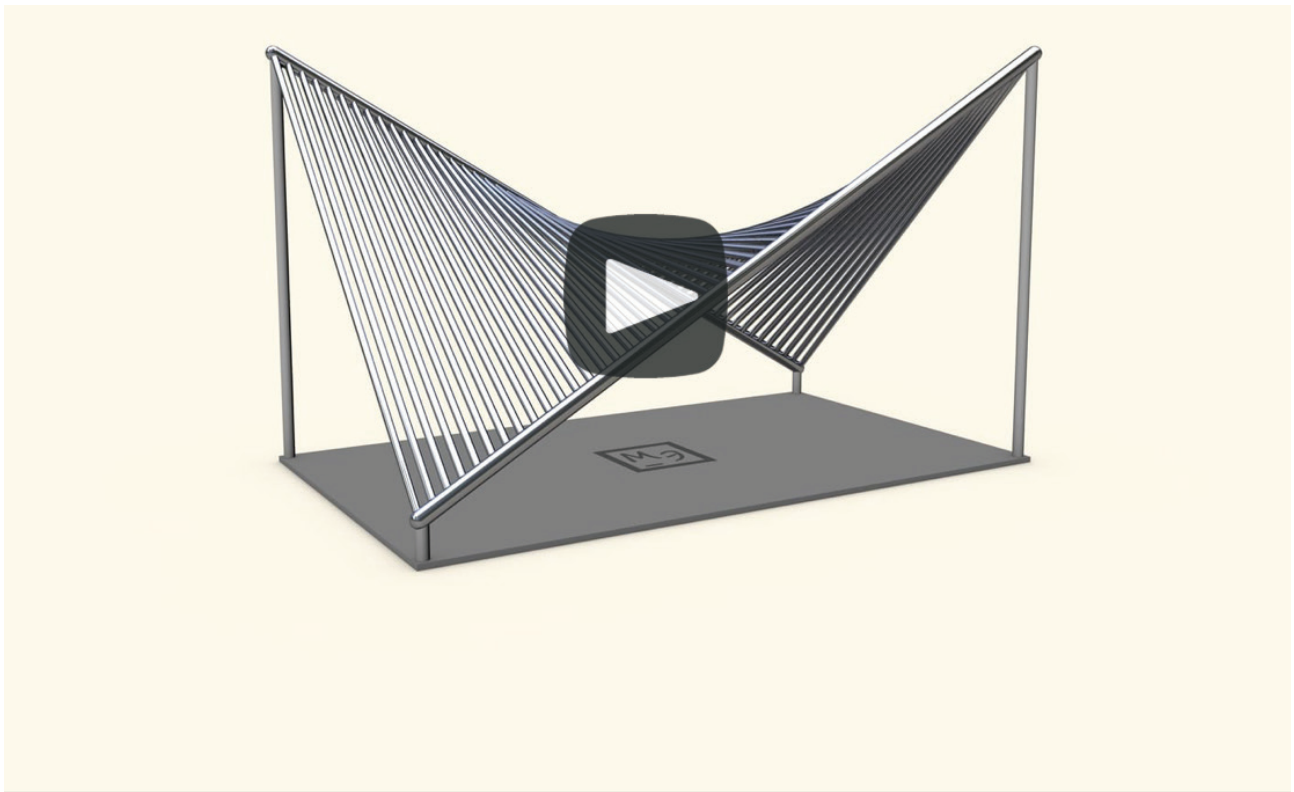


<https://www.cutoutfoldup.com/902-hyperbolic-paraboloid.php>



MATHCRAFT.WONDERHOWTO

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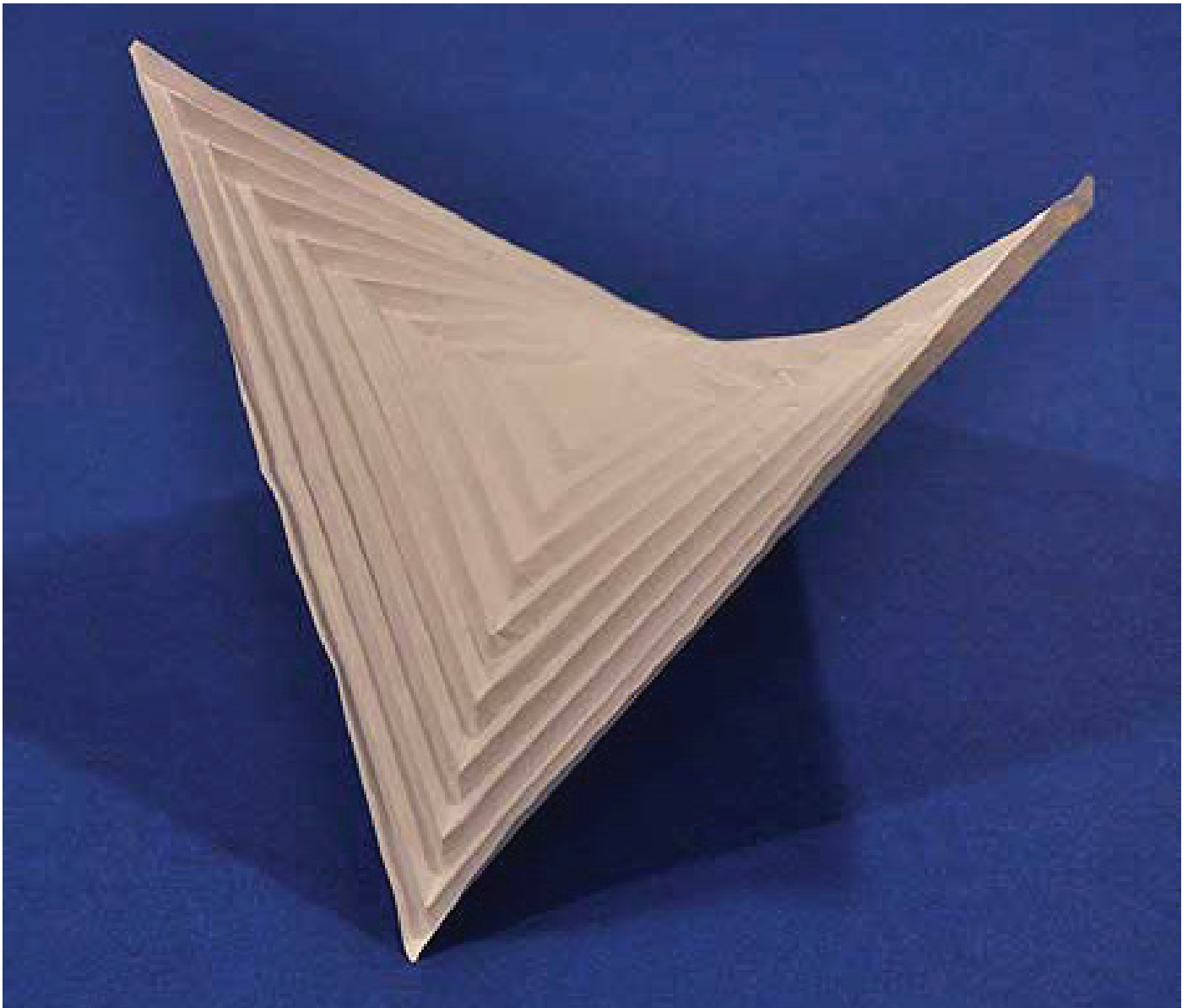


When a hyperbolic paraboloid crosses any horizontal plane, a hyperbola is formed. If a plane passes through the centre of a saddle, a hyperbola degenerates into a pair of intersecting straight lines (if we project a hyperbola from a parallel section on this plane, the straight lines will be an asymptote of a hyperbola-projection).

<https://en.etudes.ru/models/conic-sections-sadle-hyperbolic-paraboloid/>

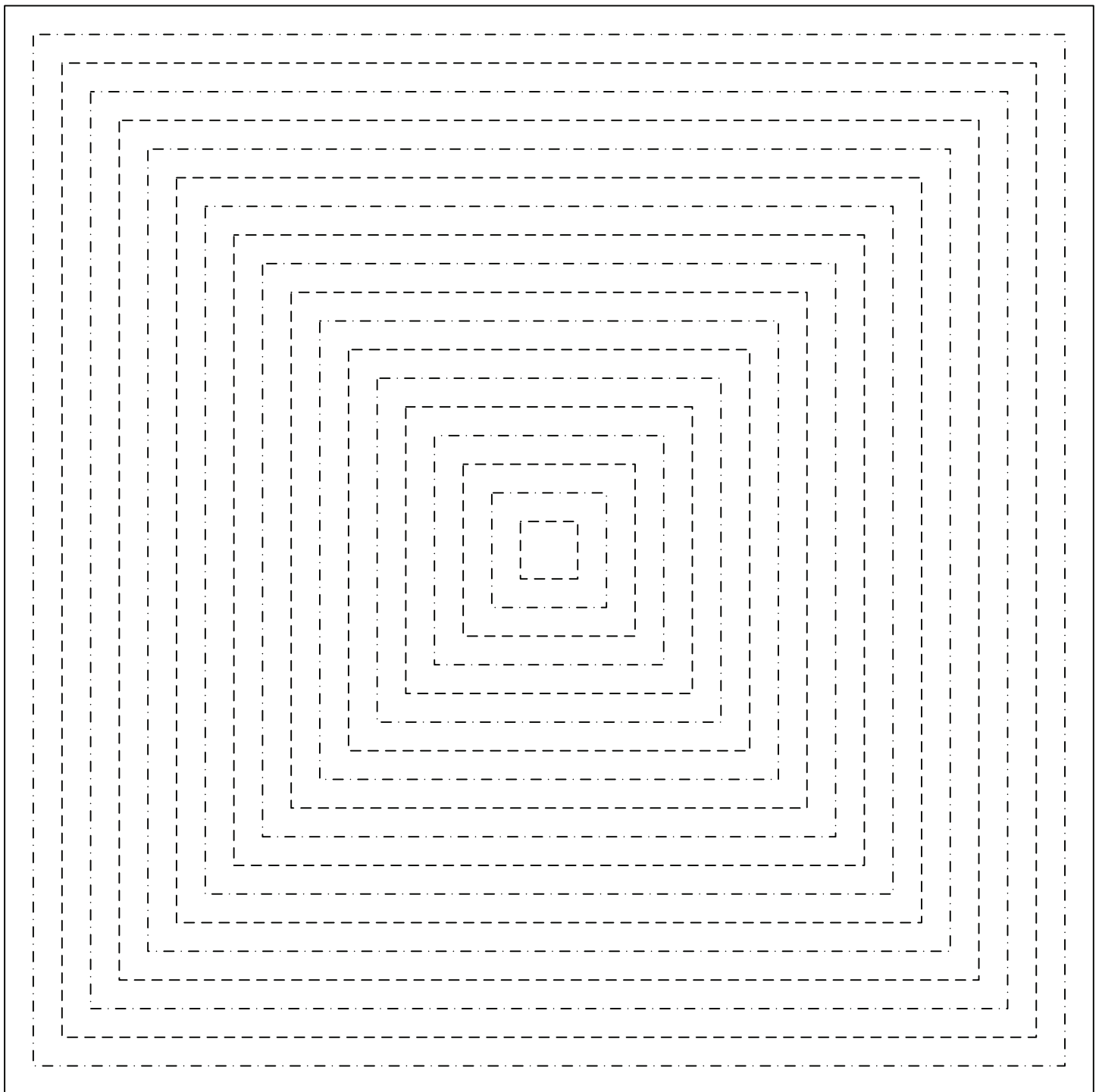


<https://en.etudes.ru/models/conic-sections-chips-hyperbolic-paraboloid/>



https://www.cutoutfoldup.com/patterns/0967_a4.pdf

Fold a Hyperbolic Paraboloid



Hyperbolic Paraboloid

