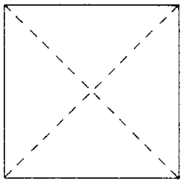
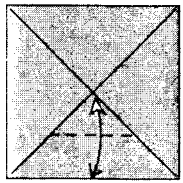
The Hyperbolic Paraboloid

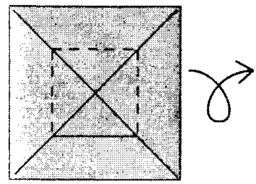
This unusual fold has been rediscovered by numerous people over the years. It resembles a 3D surface that you may recall from Multivariable Calculus.



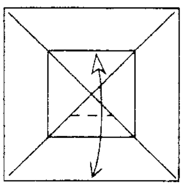
(1) Take a square and crease both diagonals. Turn over.



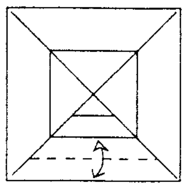
(2) Fold the bottom to the center, but **only** crease in the middle.



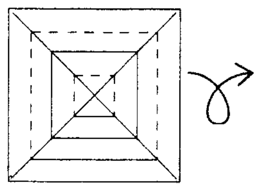
(3) Repeat step (2) on the other three sides. Turn over.



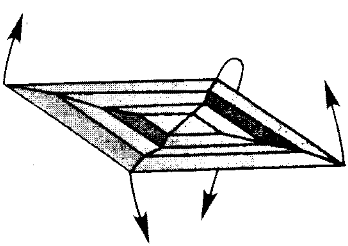
(4) Bring the bottom to the top crease line, creasing **only** between the diagonals.



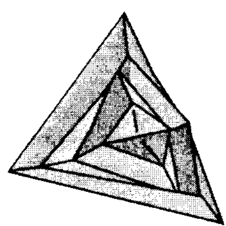
(5) Then bring the bottom to the nearest crease line. Again, do not crease all the way across.



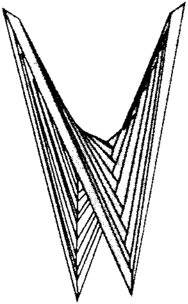
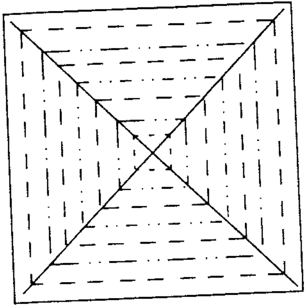
(6) Repeat steps (4) and (5) on the other three sides. Turn over.



(7) Now make all the creases at once. It may help to fold the creases on the outer ring first and work your way in.



(8) Once the creases are folded, the paper will twist into this shape, and you're done!

(9) You can make a larger one by folding more divisions in the paper. The key is to have the concentric squares alternate mountain-valley-mountain in the end. You can do steps (1)–(3), do not turn the paper over, then do 1/4 divisions in steps (4)–(6), then turn it over and make 1/8 divisions. Or you could shoot for 1/16ths!

Question: Is the hyperbolic parabola a **rigid origami** model or not? (Could it be made out of rigid sheet metal, with hinges at the creases?) Proof?