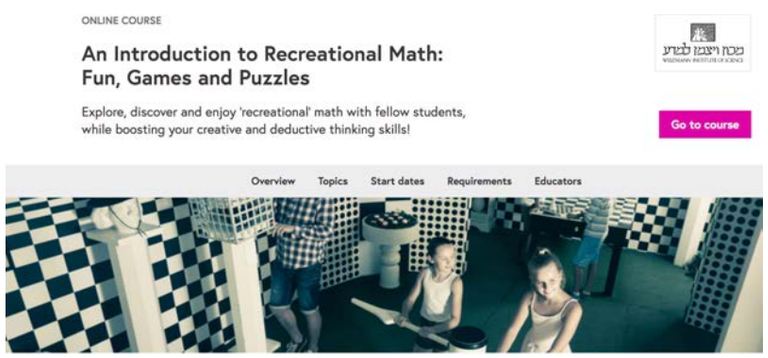
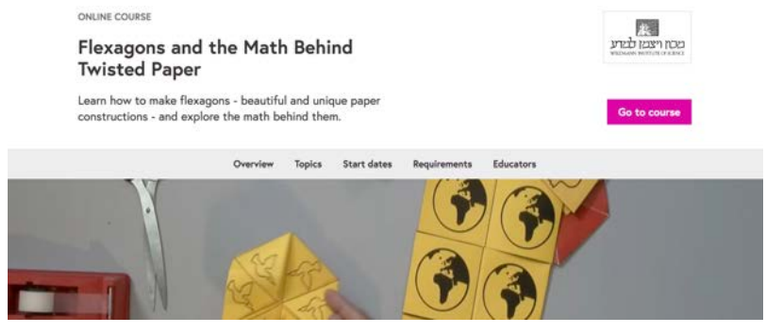
אני לא יודע - בואו ננסה! -
דברים שאפשר לעשות עם דף
A4

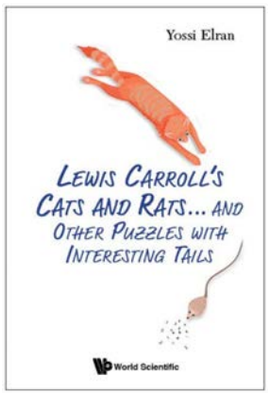
יוסי אלרן
מכון דוידסון לחינוך מדעי
מכון ויצמן למדע



8200



QUANTUM MECHANICS

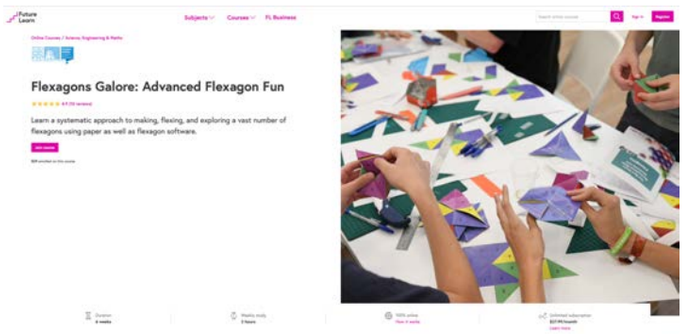


RECREATIONAL MATH

INFORMAL MATH AND SCIENCE EDUCATION

INNOVATION

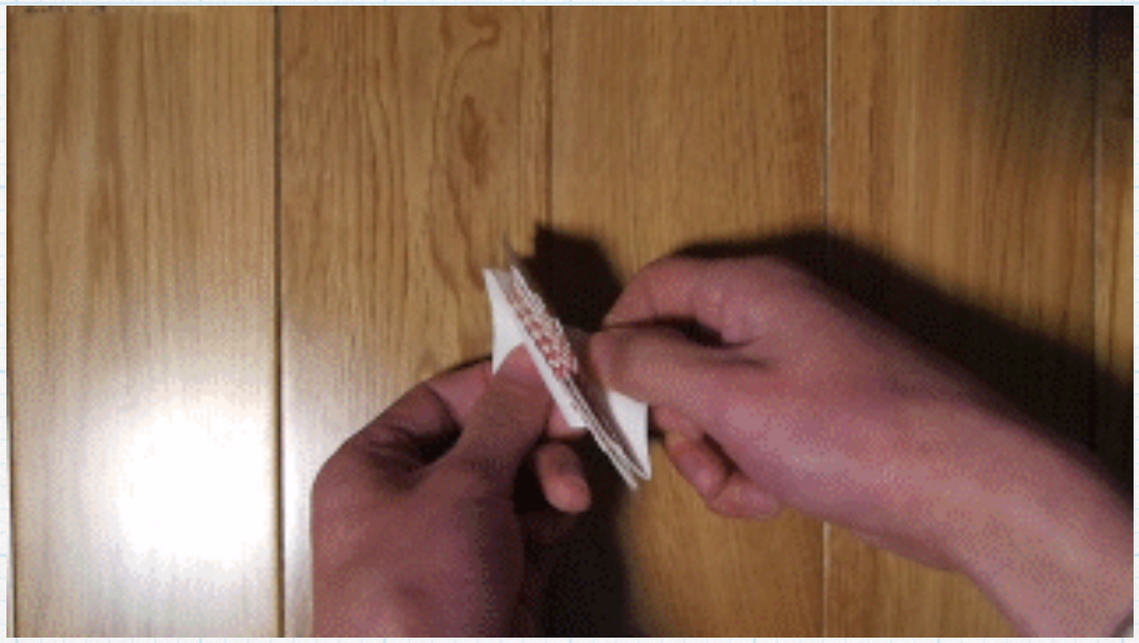
TECHNOLOGY IN EDUCATION

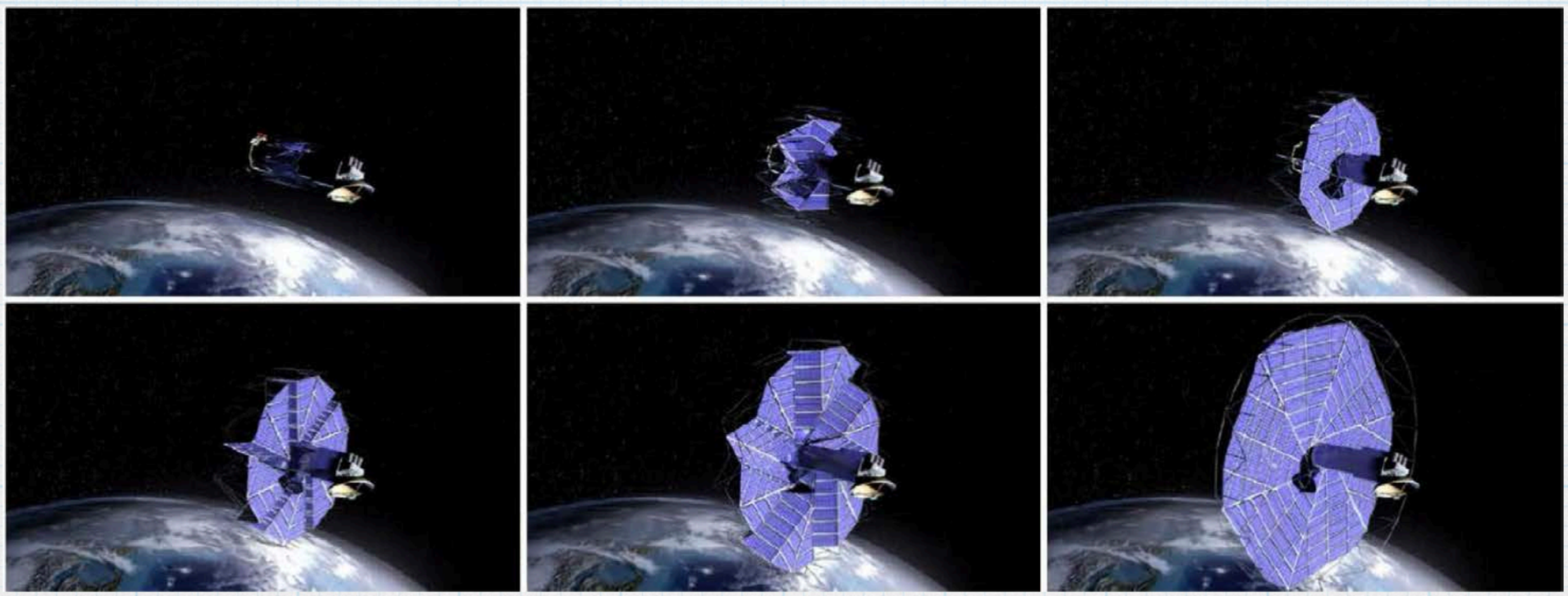


Goran Konjevod, Double Wave

Krystyna Burczyk, Just Squares

Robert Lang, Rim Pot

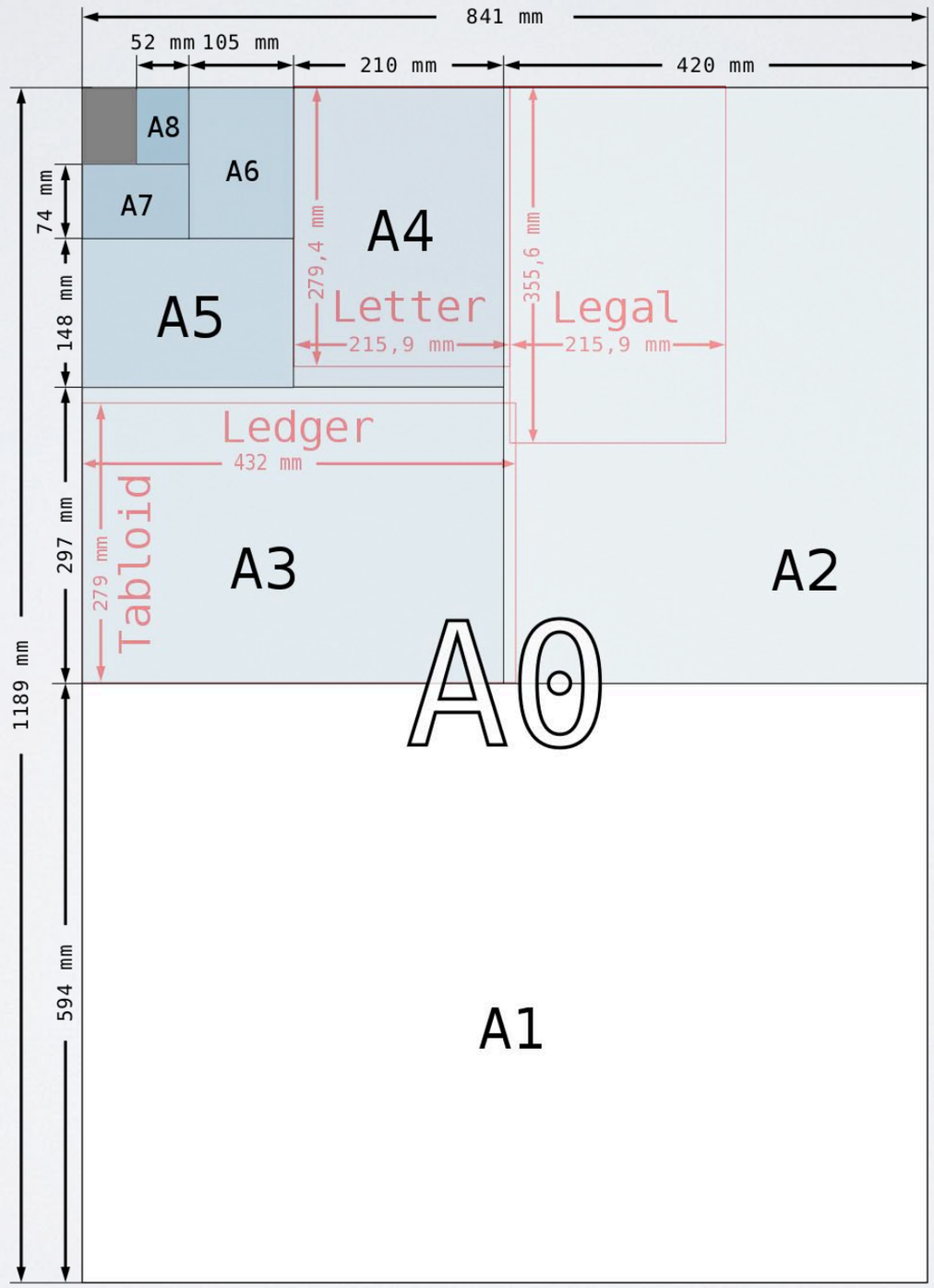




Miura Map, James Webb Telescope

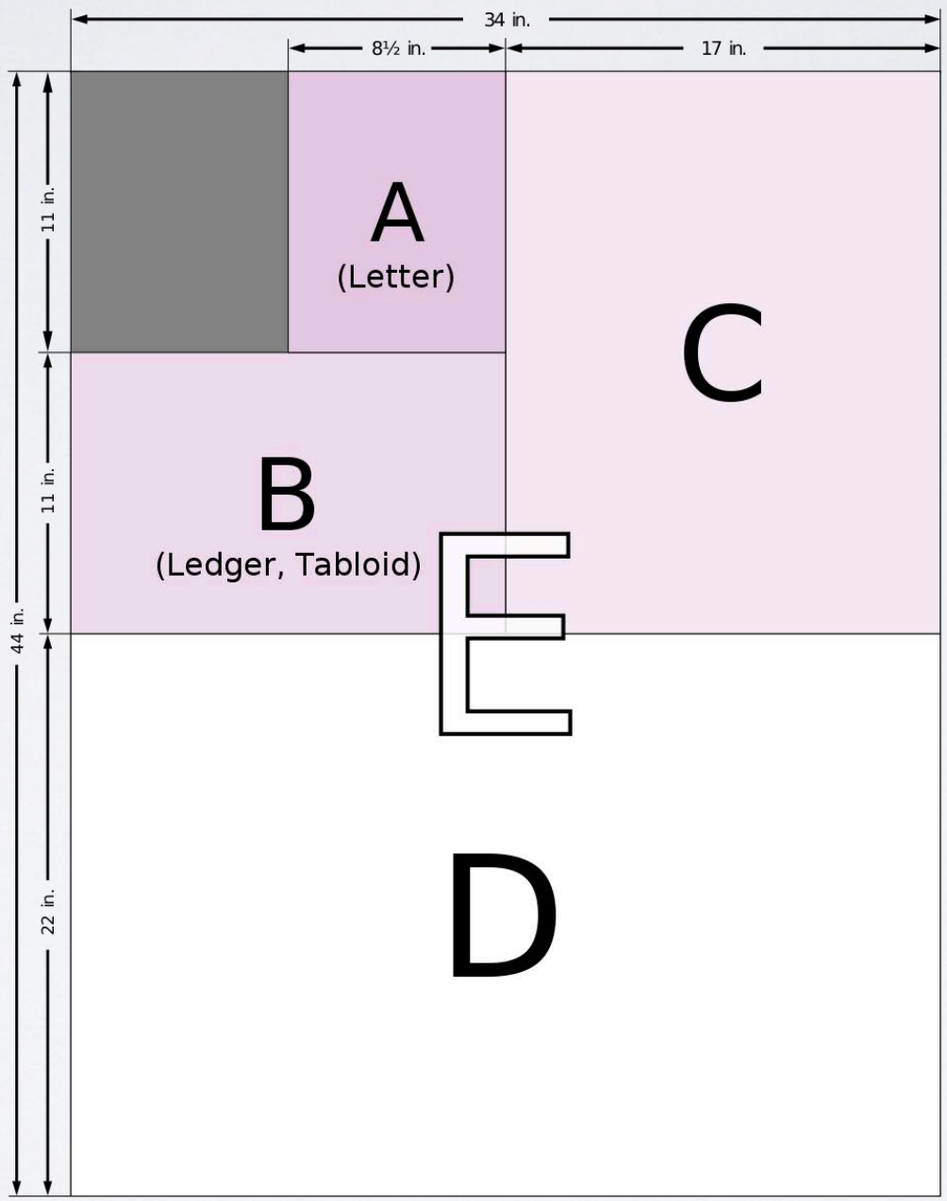
גדלים של נייר "רגיל"

$$\frac{1}{\sqrt[4]{2}}\ \mathrm{m}$$



$$\sqrt[4]{2}\ \mathrm{m}$$

גדלים של נייר

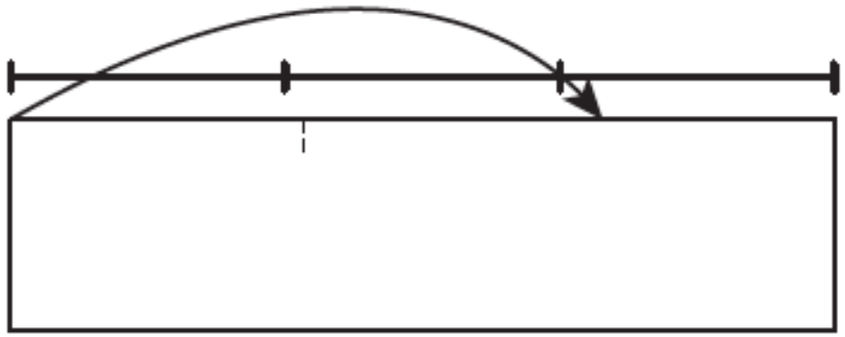


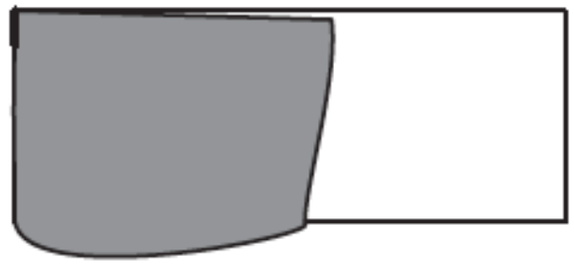
קיפול אורכים?

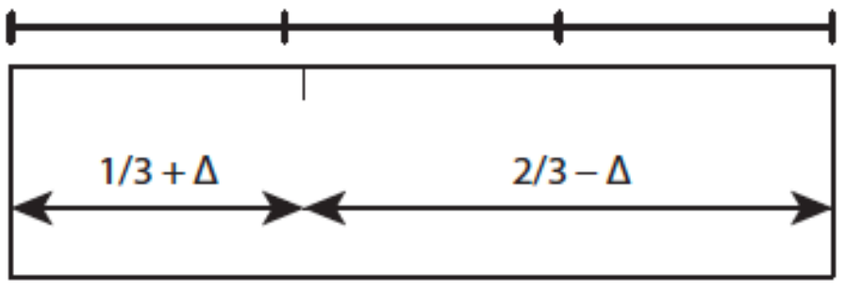
אלו אורכים אפשר לקפל במדויק?

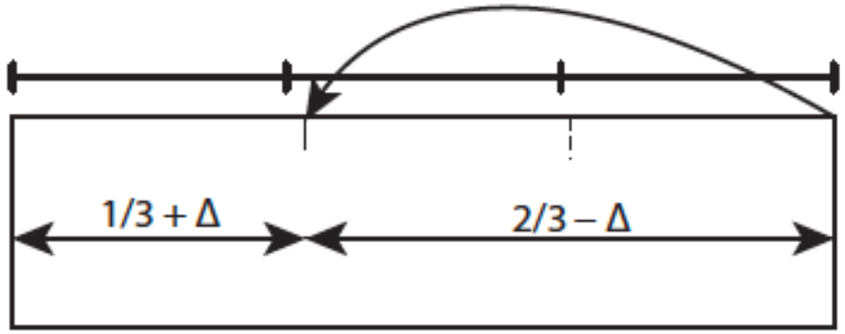
1/2 1/4 1/8 1/16 $1/2^n$

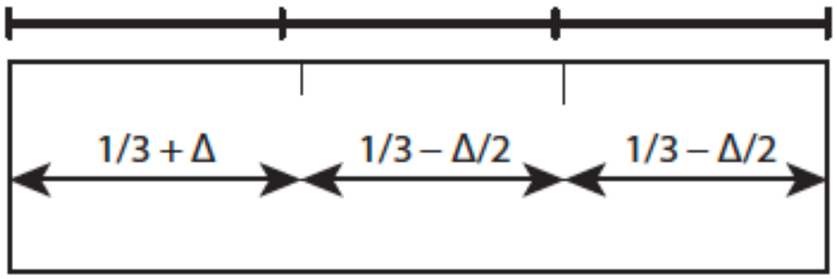
קירוב פוג׳ימוטו

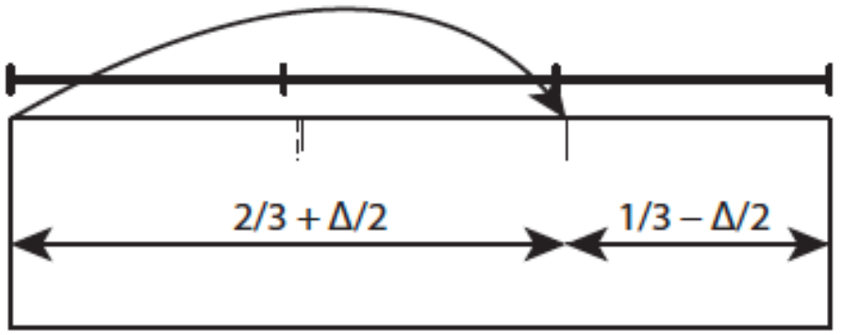


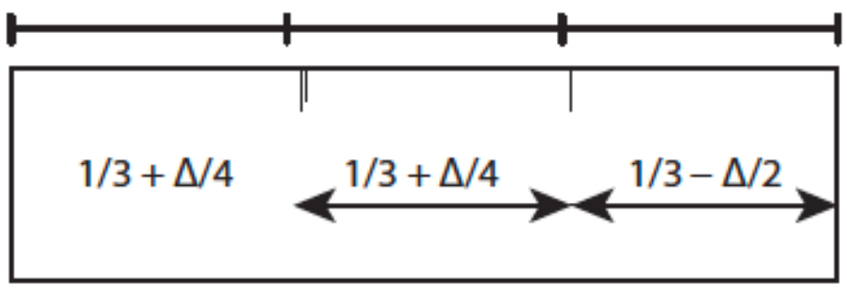


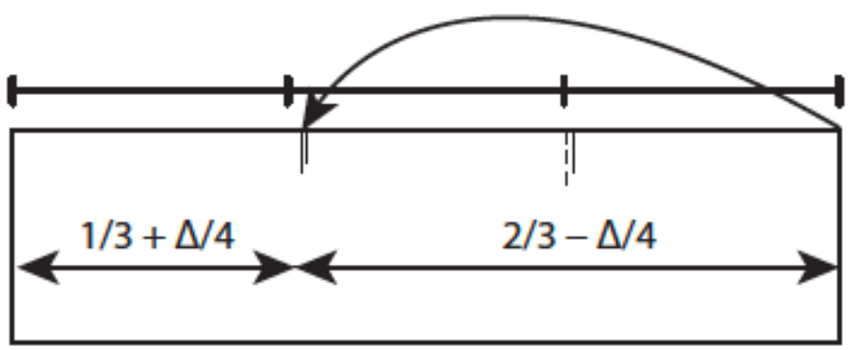








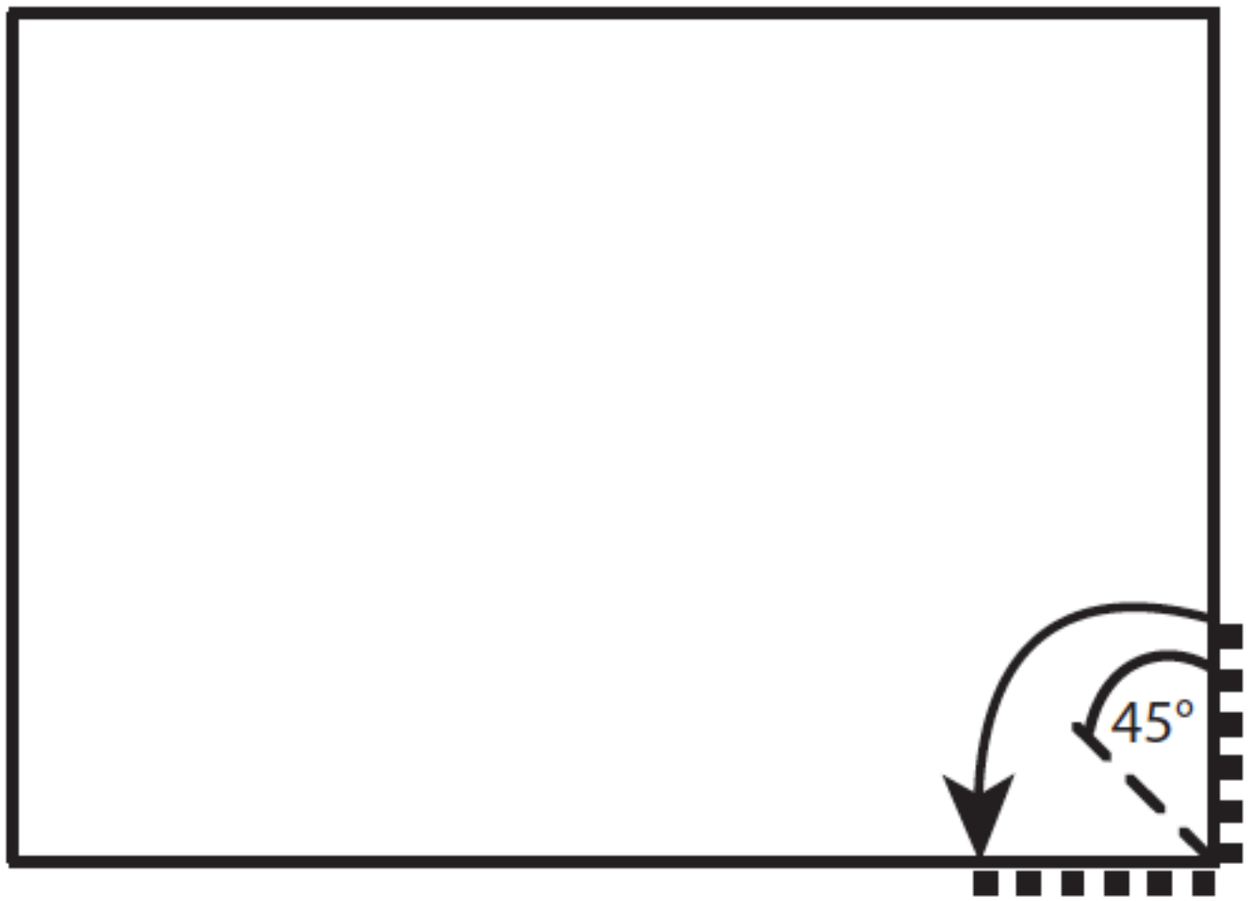




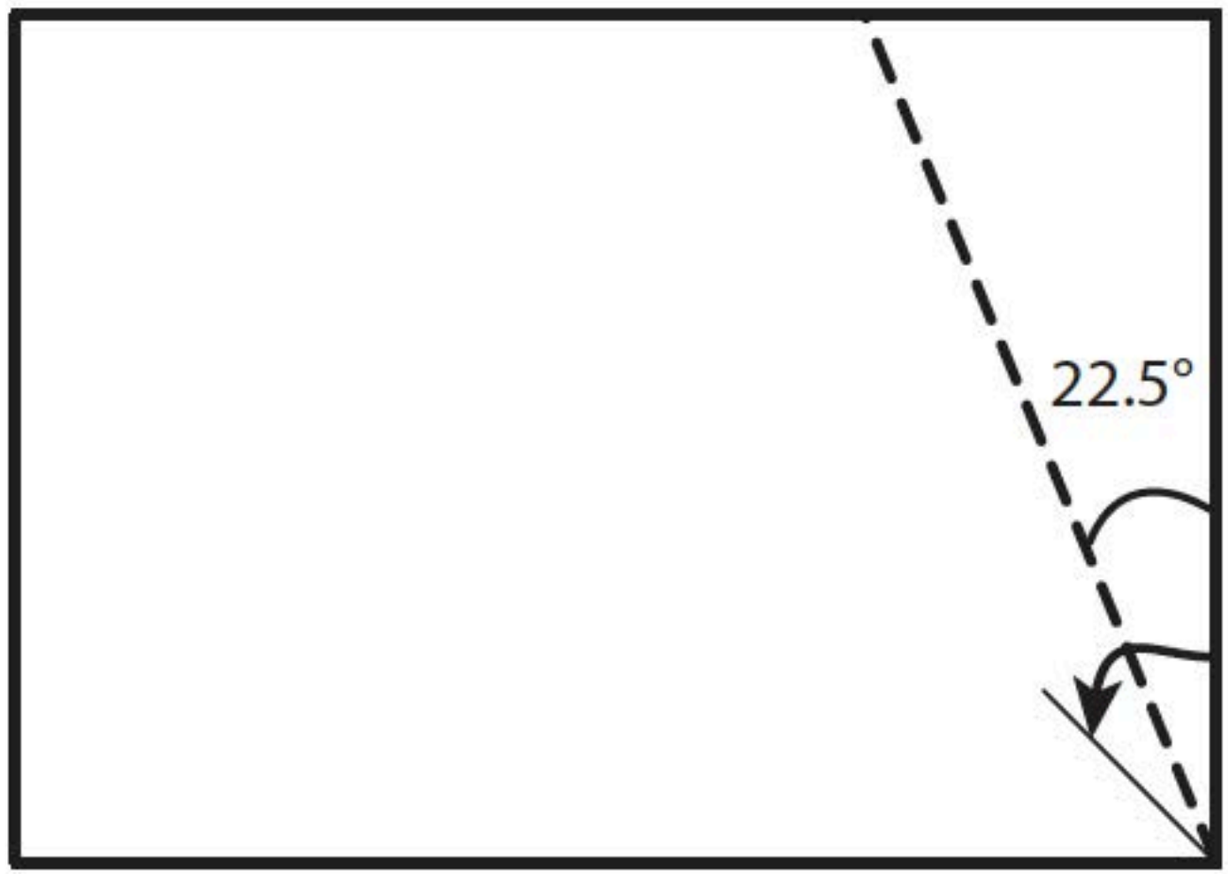
קיפול זוויות

אלו זוויות אפשר לקפל במדויק?

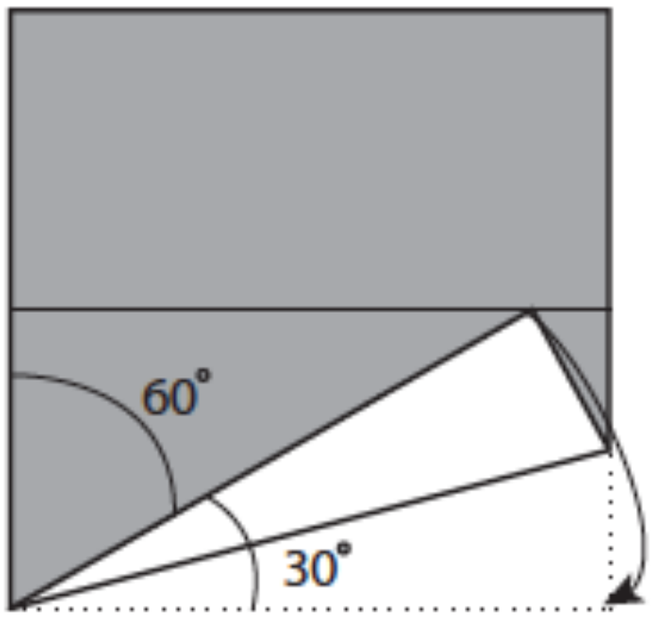
קיפול זוויות

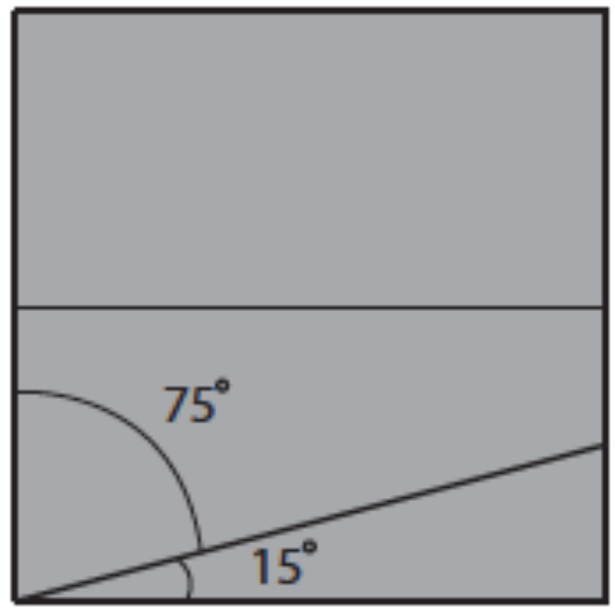


קיפול זוויות

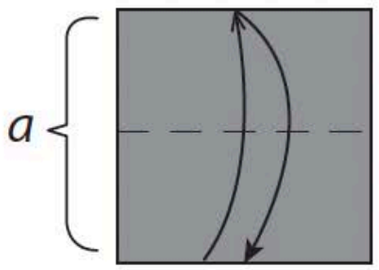


קיפול זוויות

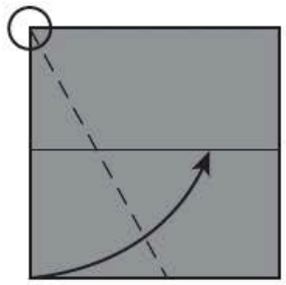




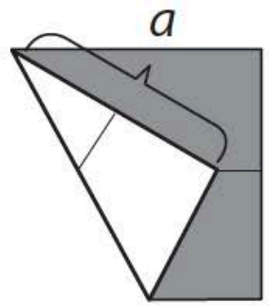
Dividing into Three Equal Parts



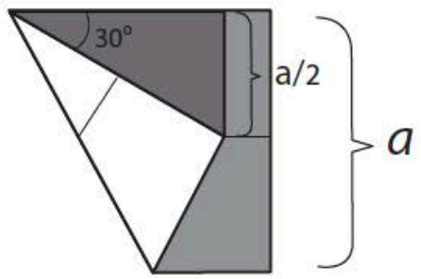
Fold edge to edge and unfold.



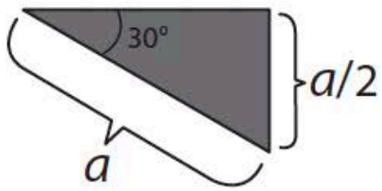
Fold bottom left corner to the crease line. Make sure the fold line starts at the top left corner!



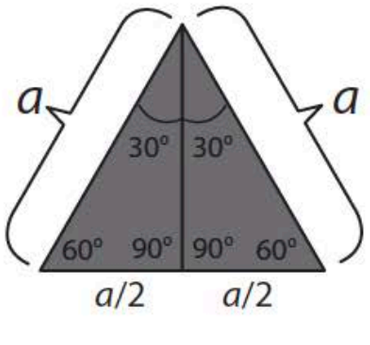
The marked edge's length is *a*.



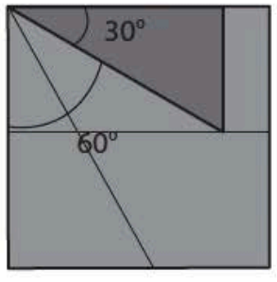
The dark gray triangle has an edge length of *a*/2 on the right.



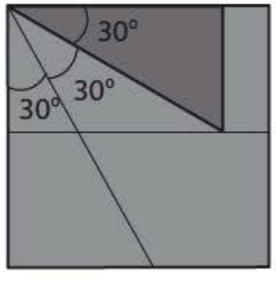
This triangle has an edge length of *a*/2 on the right and *a* as the longer edge. As one angle is 90°, this means the narrower angle is 30°.



If we mirror reflect the triangle, we can see why.



By unfolding we can see the marked angle must be 60°.



As both uncovered angles must be equal, each is 30°, so the square corner is divided into three!

קיפול זוויות

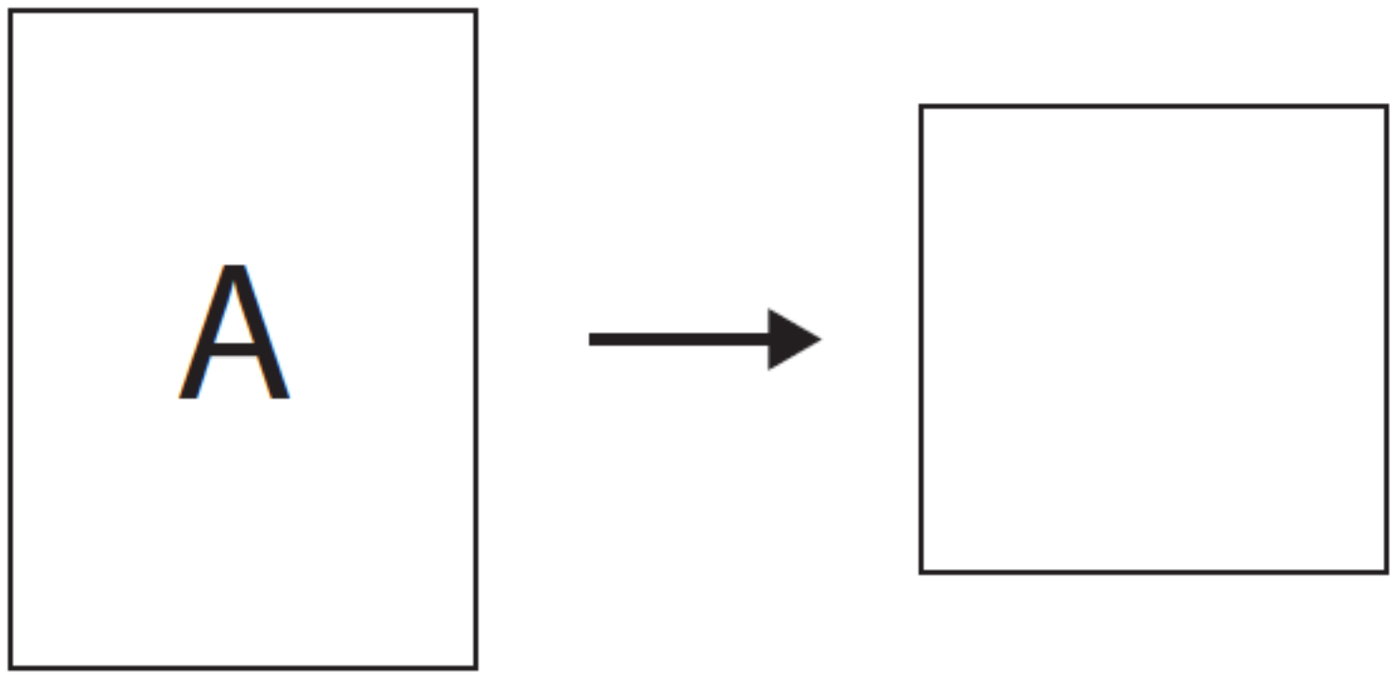
אלו זוויות אפשר לקפל במדויק?

90, 45, 22.5, 11.25 ...

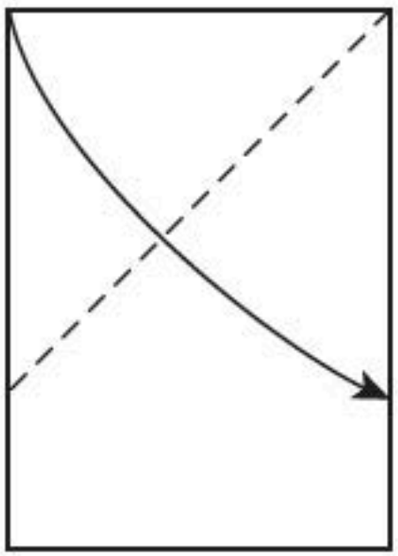
60, 30, 15, 7.5 ...

... וכל קומבינציה לינארית שלהן

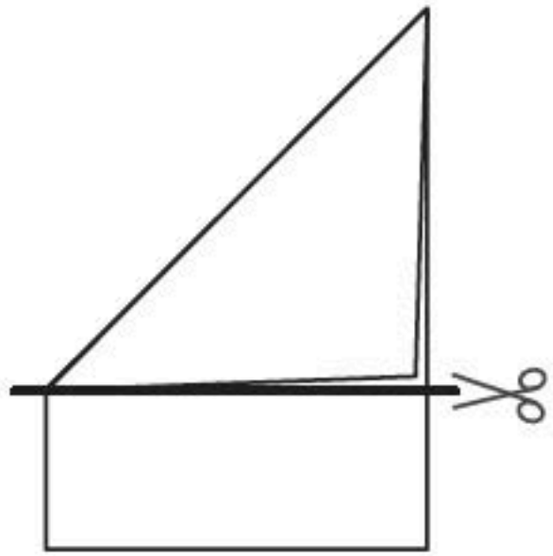
מלבן לריבוע



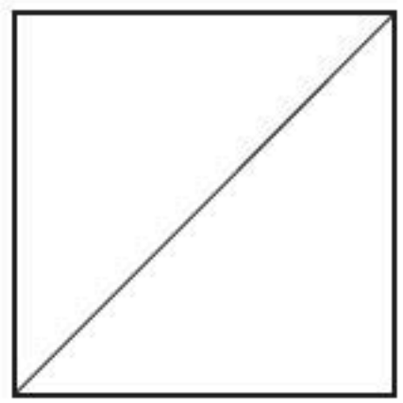
מלבן לריבוע



Fold the top edge until it aligns with the right edge. Make sure the corner you get is 45°!

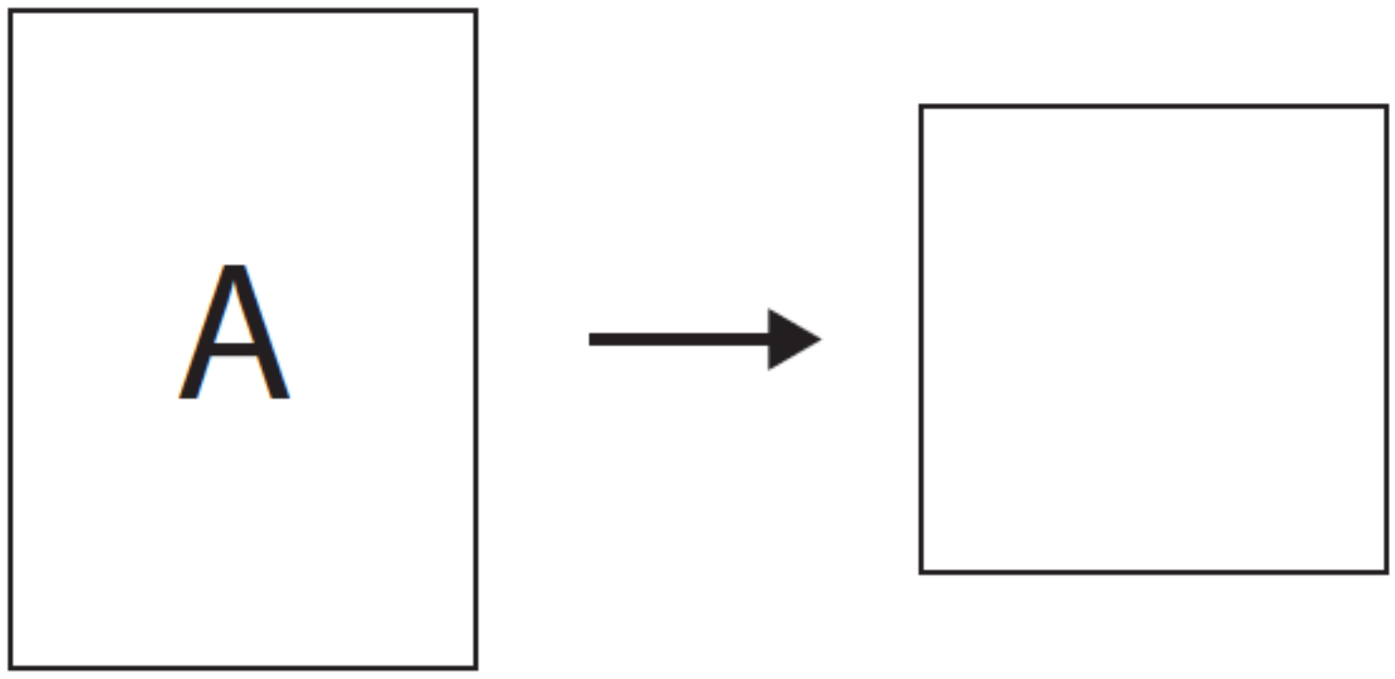


Use the folded edge as a guide and cut the excess flap.

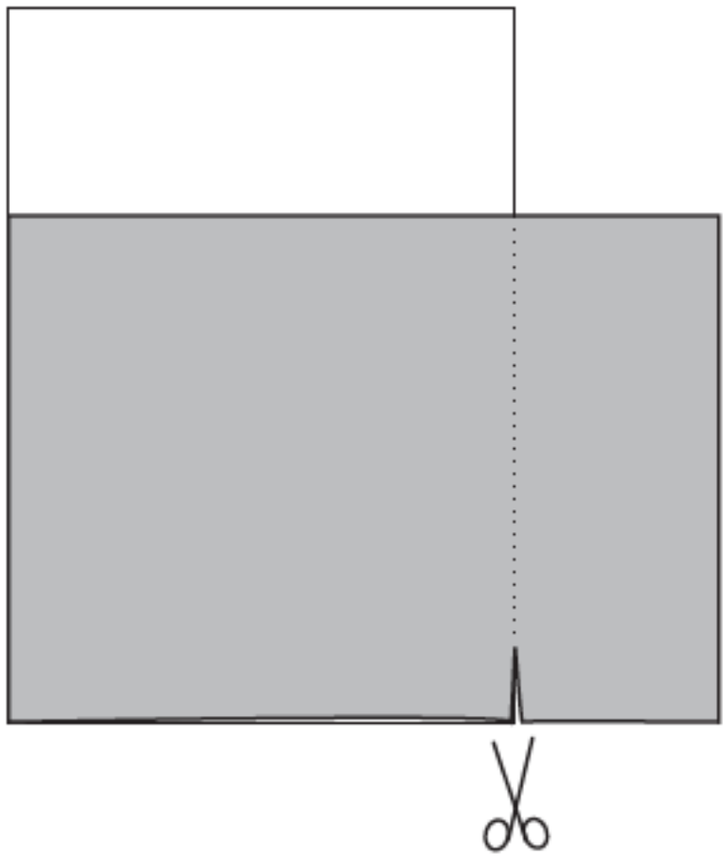


Unfold, to see a crease line along the diagonal.

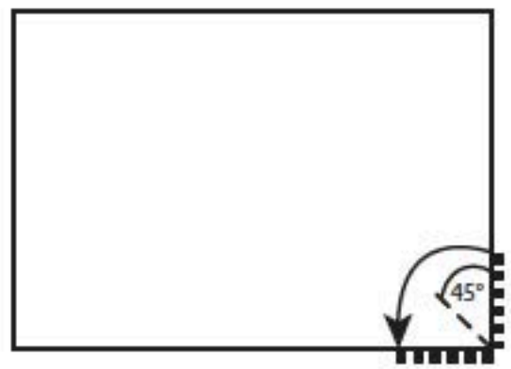
מלבן לריבוע, בלי לקמט את הדף!



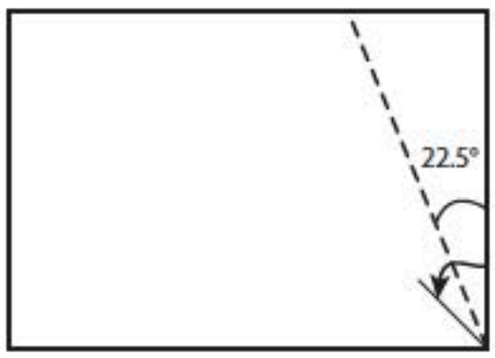
מלבן לריבוע, בלי לקמט את הדף!



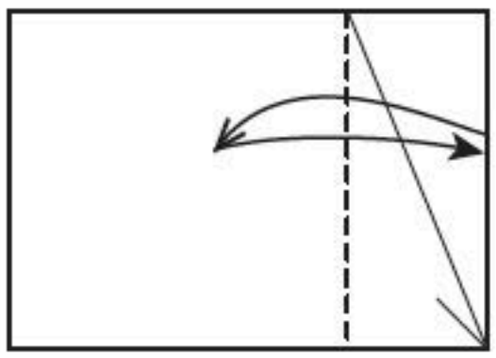
מלבן לריבוע, בלי לקמט את הדף!



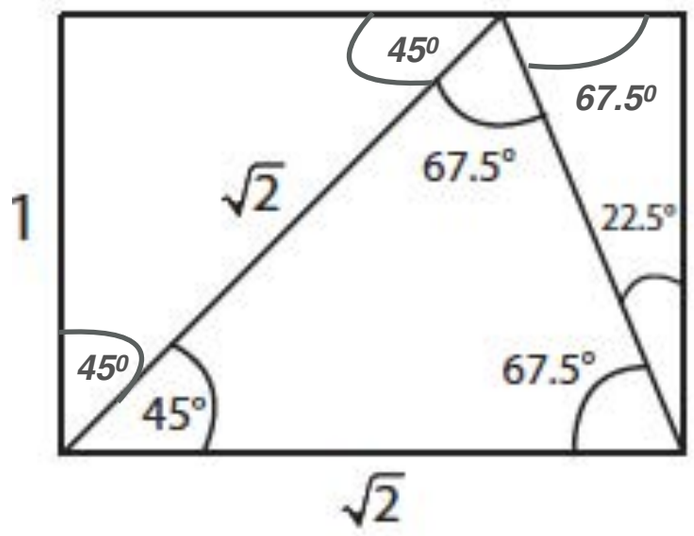
Fold right edge (marked) to bottom edge (marked), but crease only a little, to create a 45° guide line.



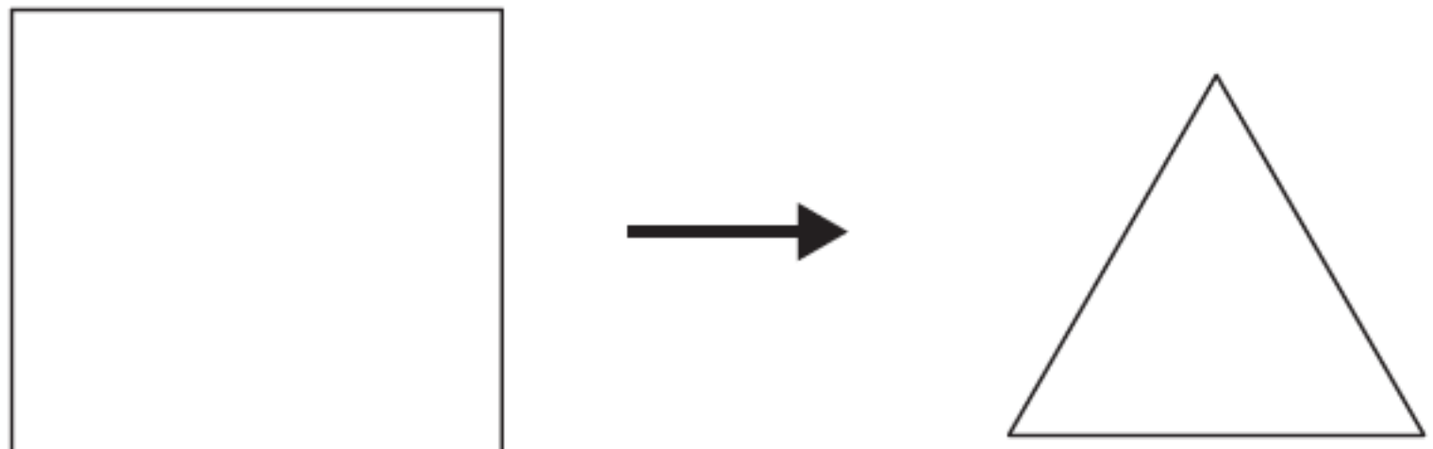
Fold right edge to the new crease line, and fold all the way.



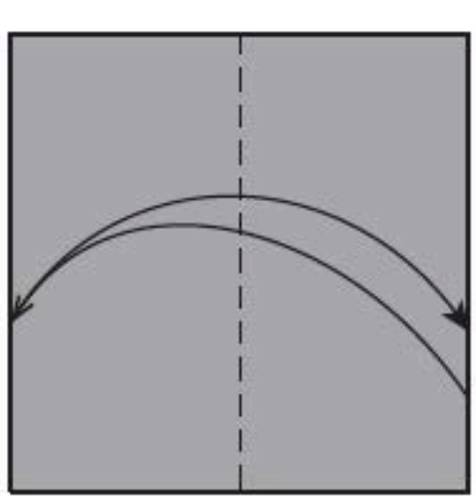
Fold the right edge so the fold starts where the last crease meets the top edge. Unfold.



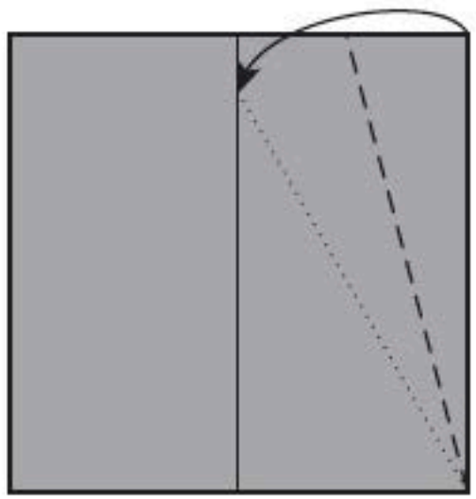
SQUARE TO EQUILATERAL TRIANGLE



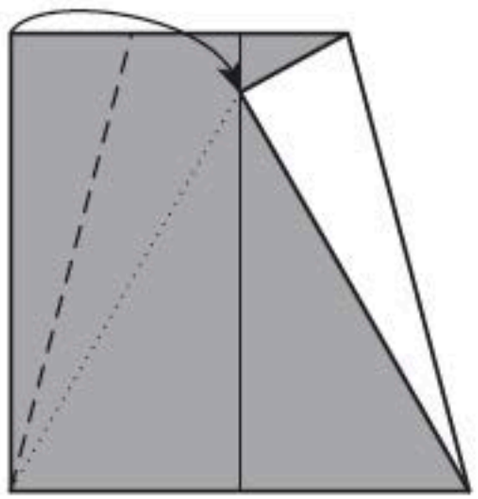
SQUARE TO EQUILATERAL TRIANGLE



Fold edge to edge and unfold.



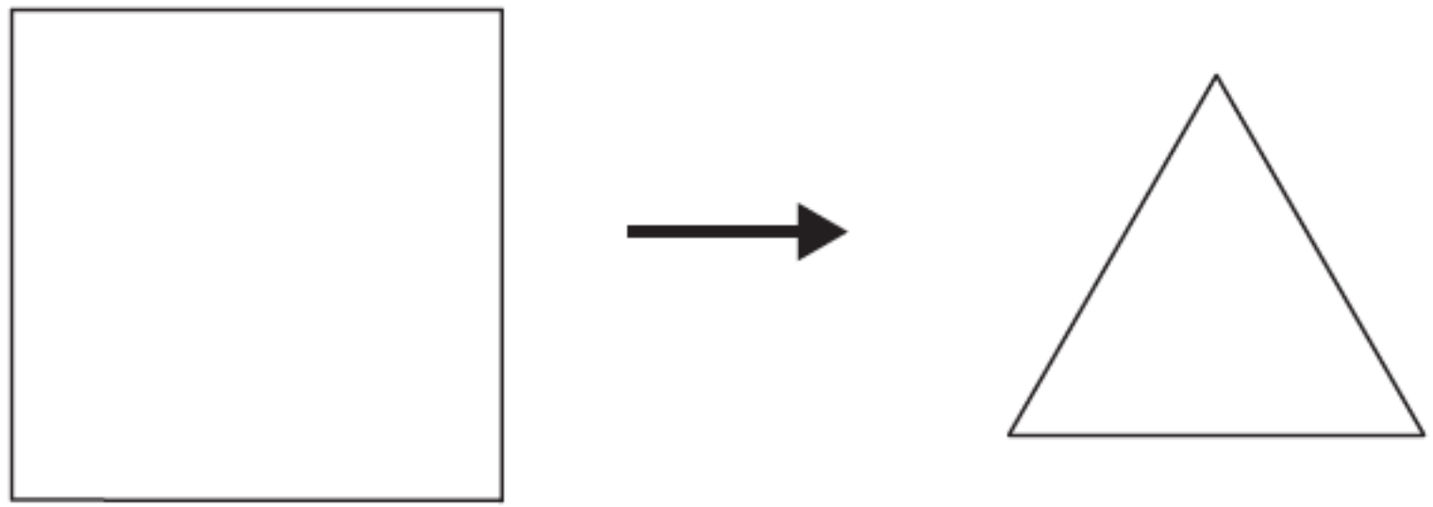
Fold the top right corner to the center line. Make sure the crease starts at the bottom right corner.



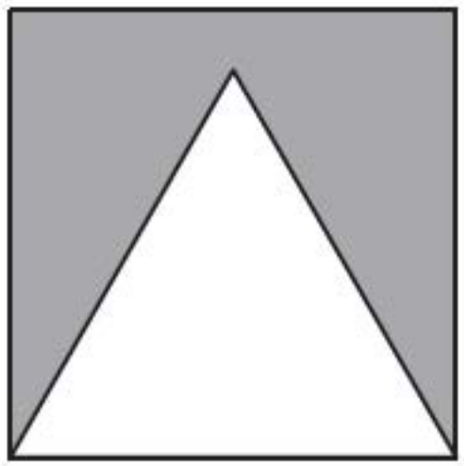
Repeat on the left.

SQUARE TO EQUILATERAL TRIANGLE

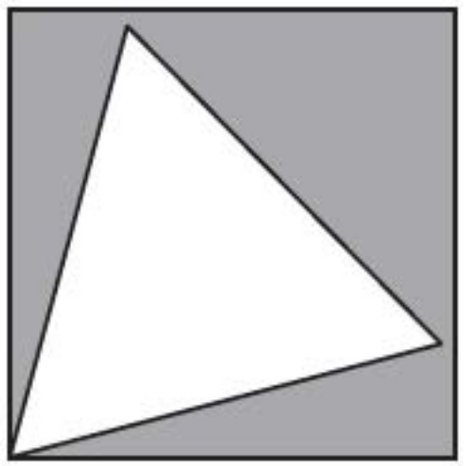
MAXIMUM AREA



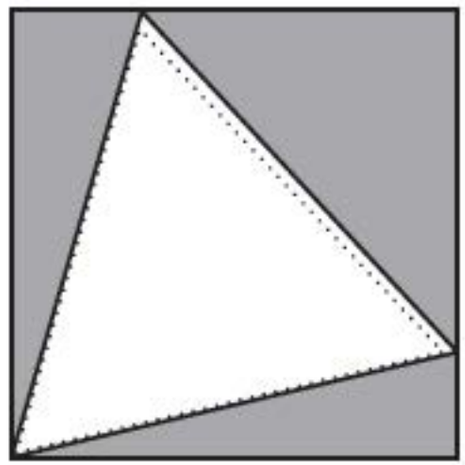
SQUARE TO EQUILATERAL TRIANGLE
MAXIMUM AREA



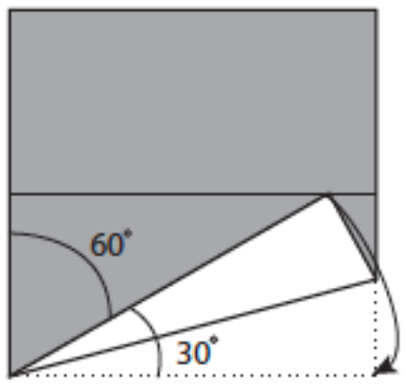
The first solution …



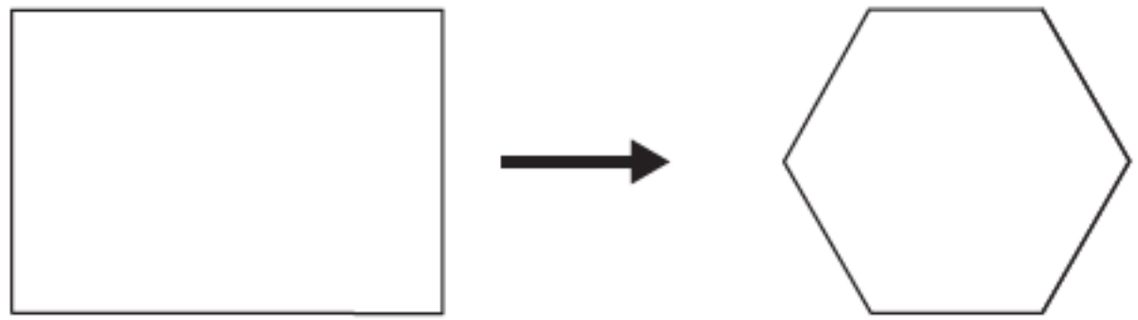
… can be rotated …



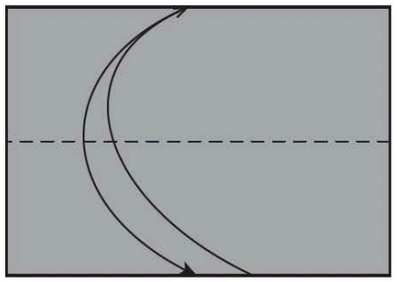
… and enlarged.



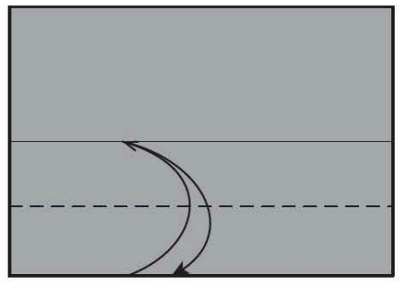
RECTANGLE TO REGULAR HEXAGON



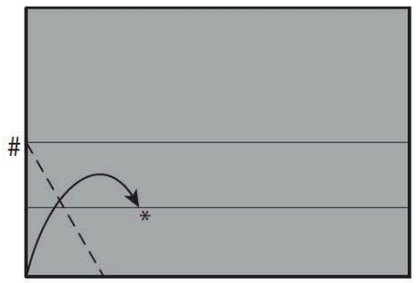
RECTANGLE TO REGULAR HEXAGON



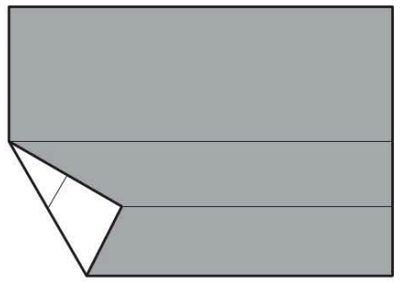
Fold in half horizontally and unfold.



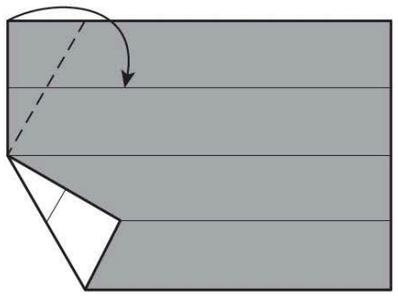
Fold the lower edge to the center line and unfold (to mark the quarter line).



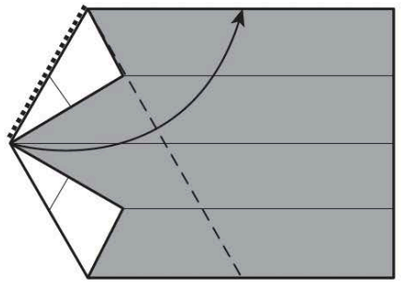
Fold the lower left corner to the quarter line (*), and make sure the fold line starts at the (#) mark.



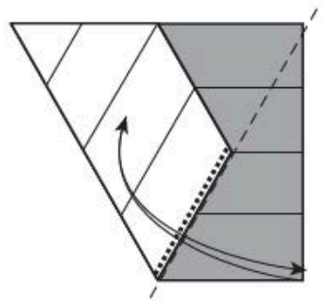
This creates a 30° angle.



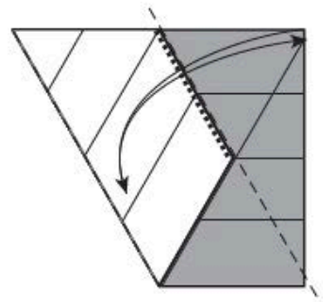
Repeat on the upper edge.



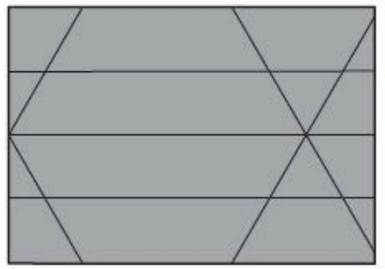
Fold the marked edge to the top edge.



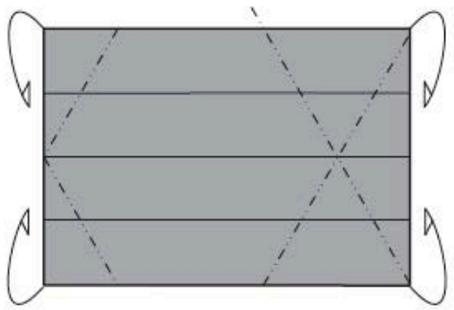
Fold the right flap along the marked edge and unfold.



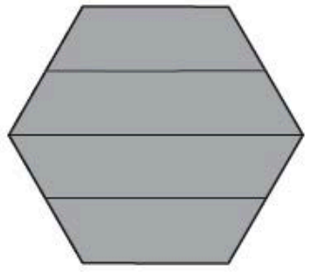
Fold the right flap along the marked edge and unfold.



Unfold everything.

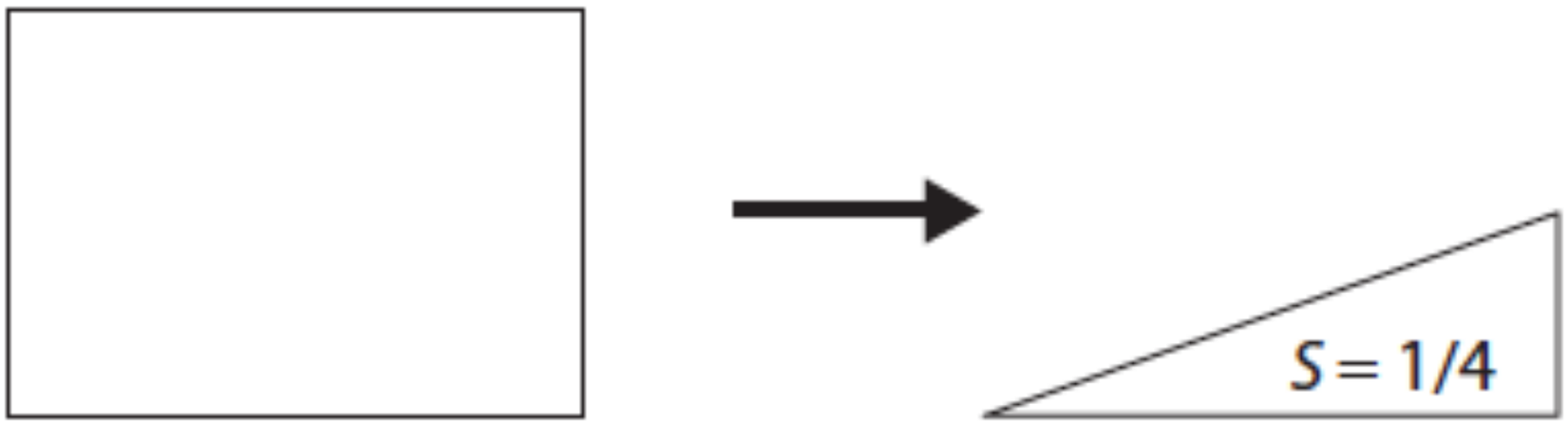


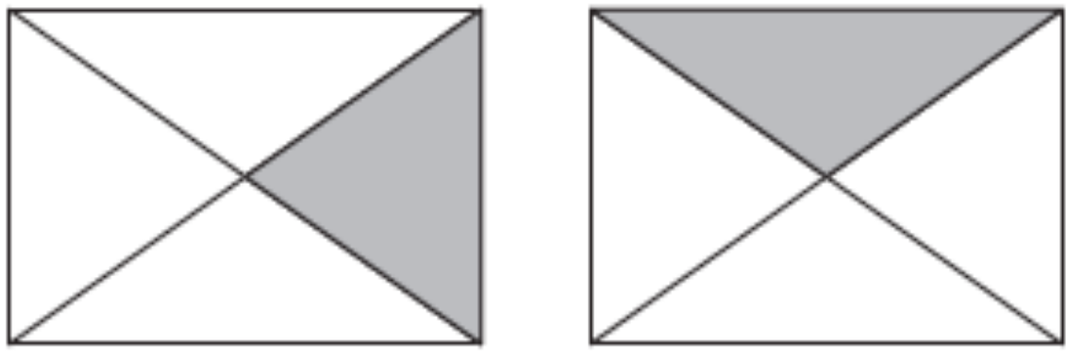
The four fold lines create a hexagon! Tuck all excess paper behind.

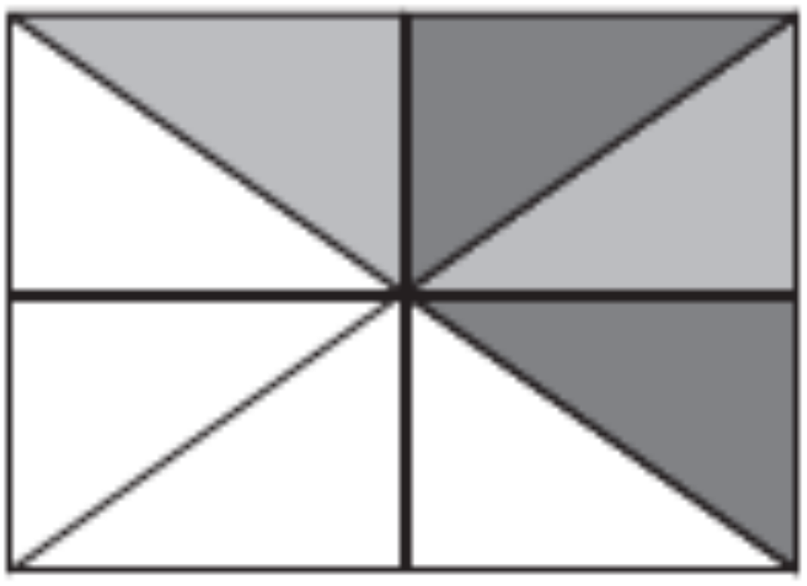


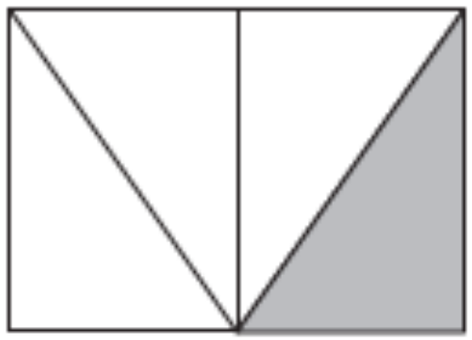
The hexagon is ready!

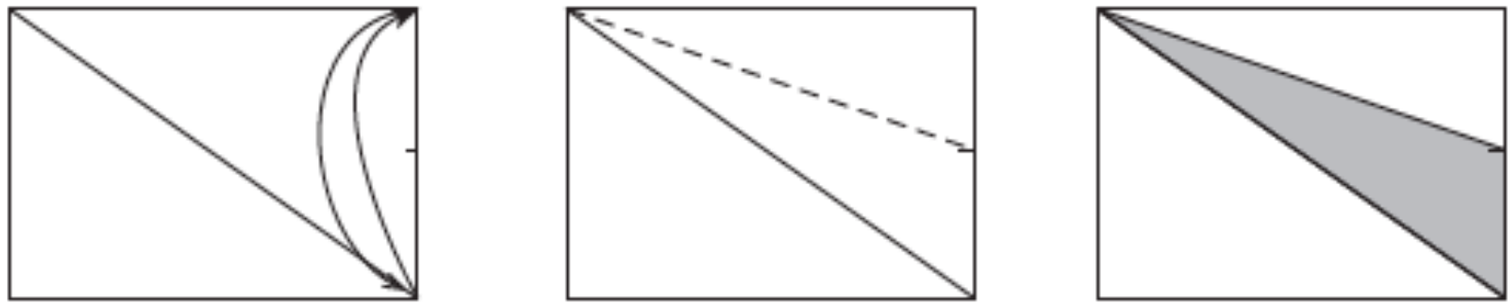
MAKE A TRIANGLE ¼ OF THE AREA OF A RECTANGLE USING ONLY 2 FOLDS





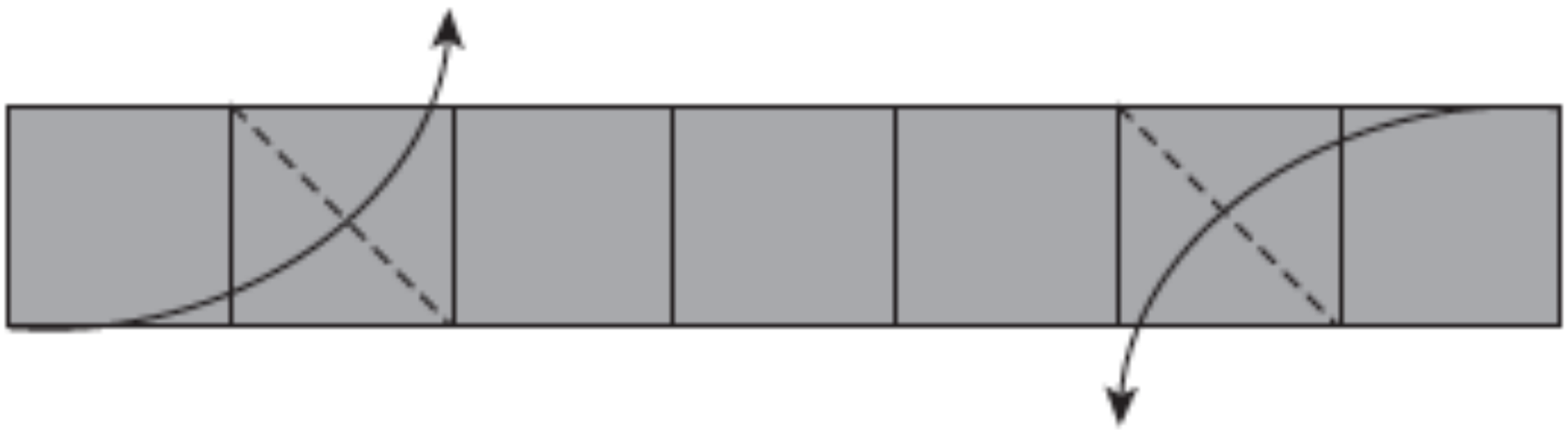




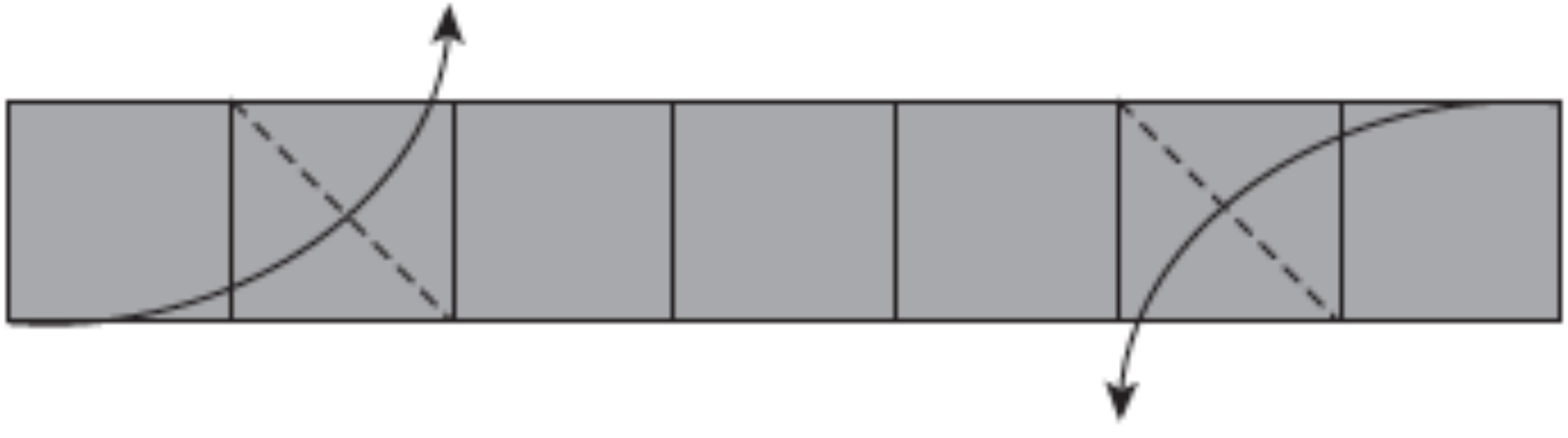


רצועה לקוביה

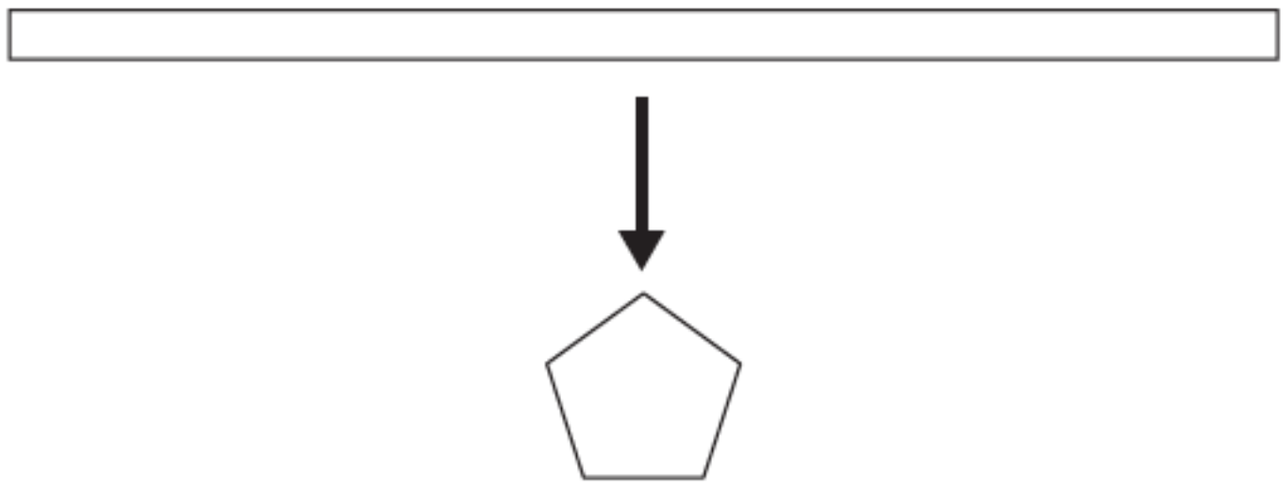
רצועה לקוביה



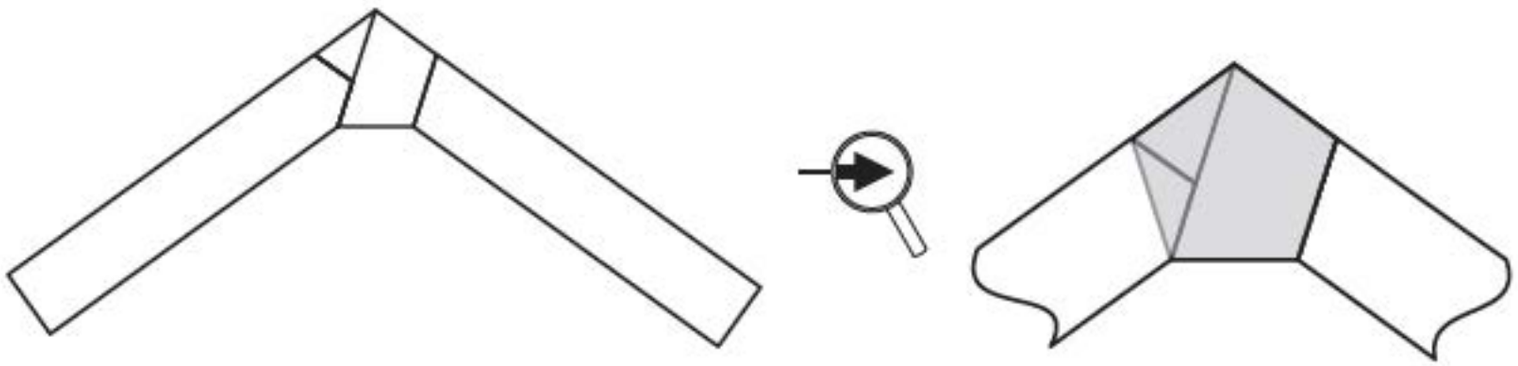
רצועה לקוביה



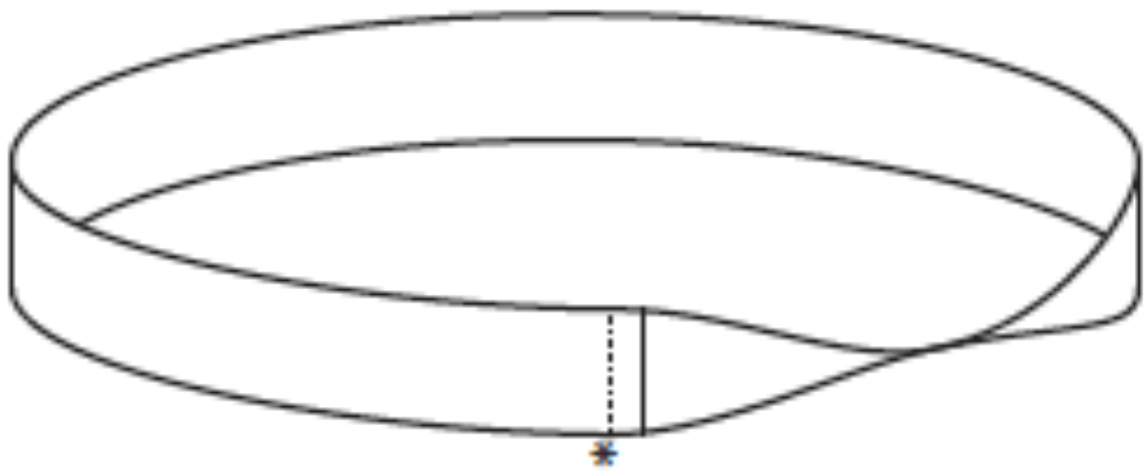
רצועה למחומש



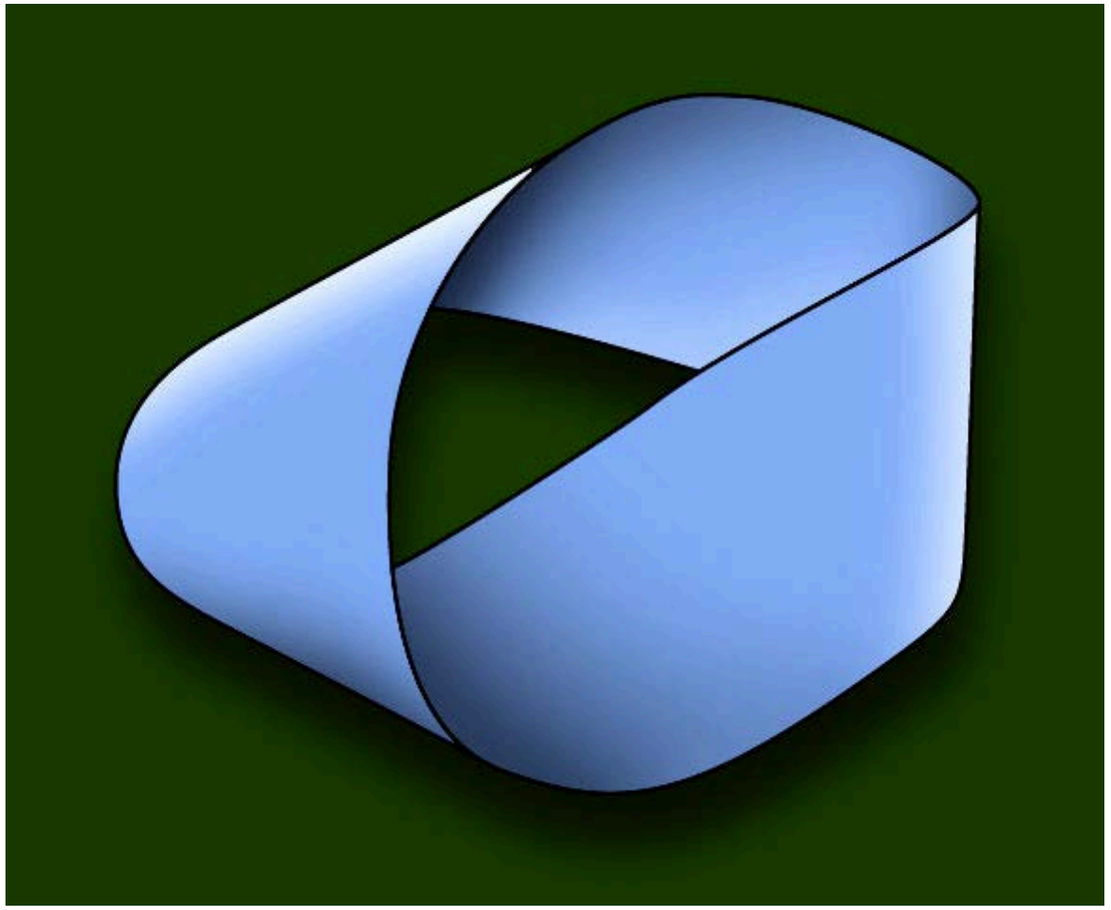
רצועה למחומש



רצועה לטבעת מוביוס

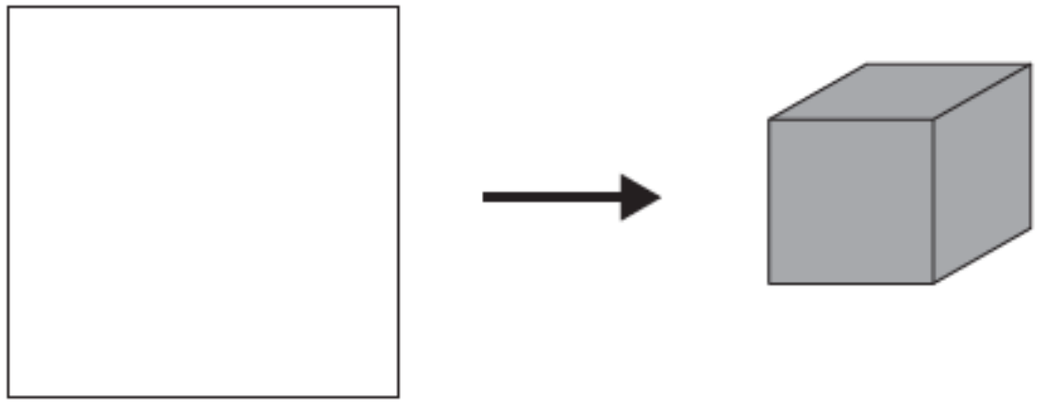


טבעות פרדומיות

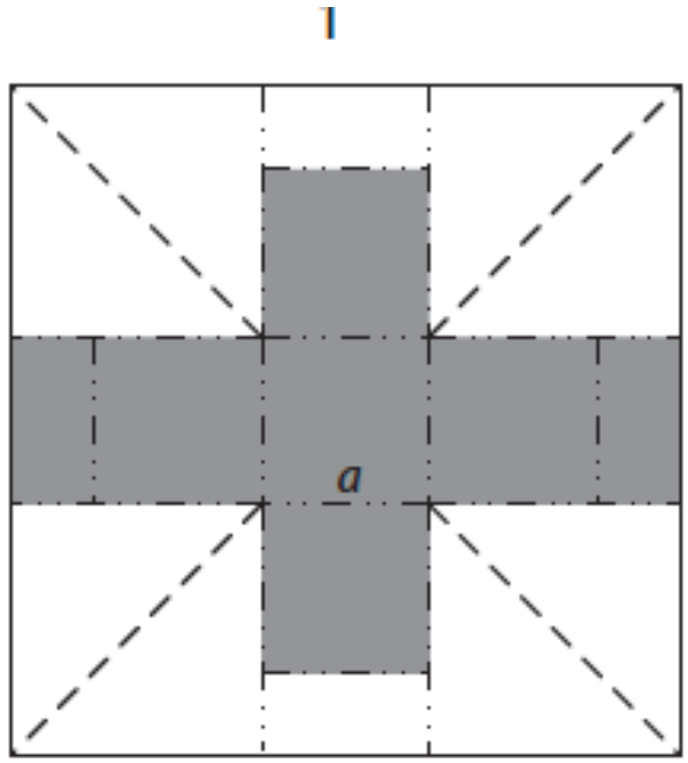


תודה רבה!

CUBE WRAPS



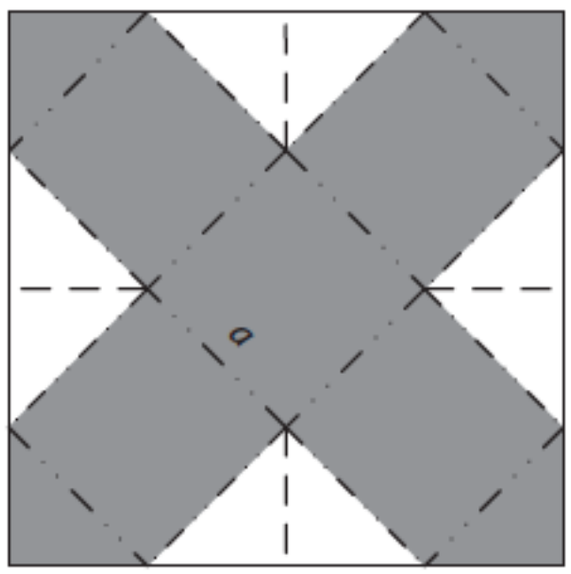
CUBE WRAPS



$a = 1/4$

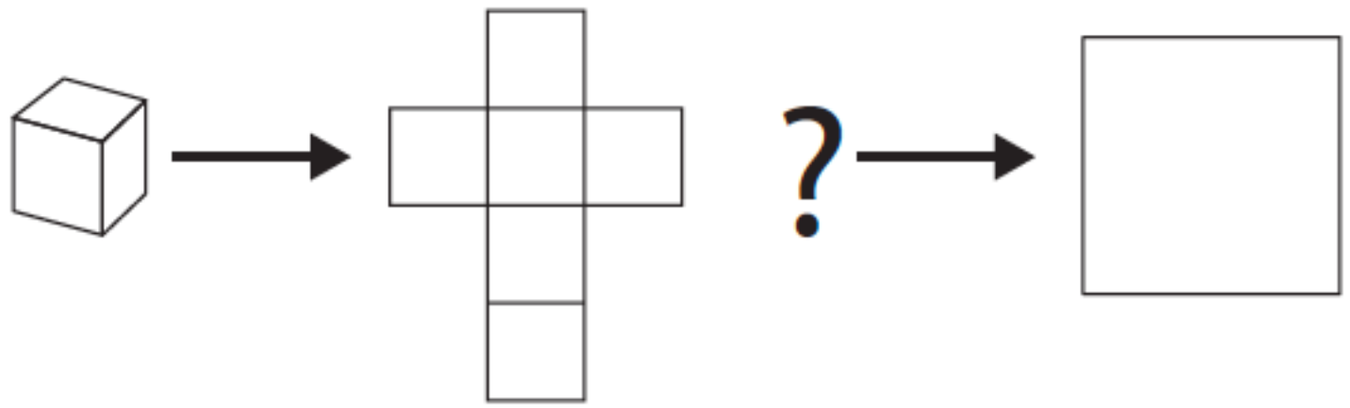
CUBE WRAPS

1

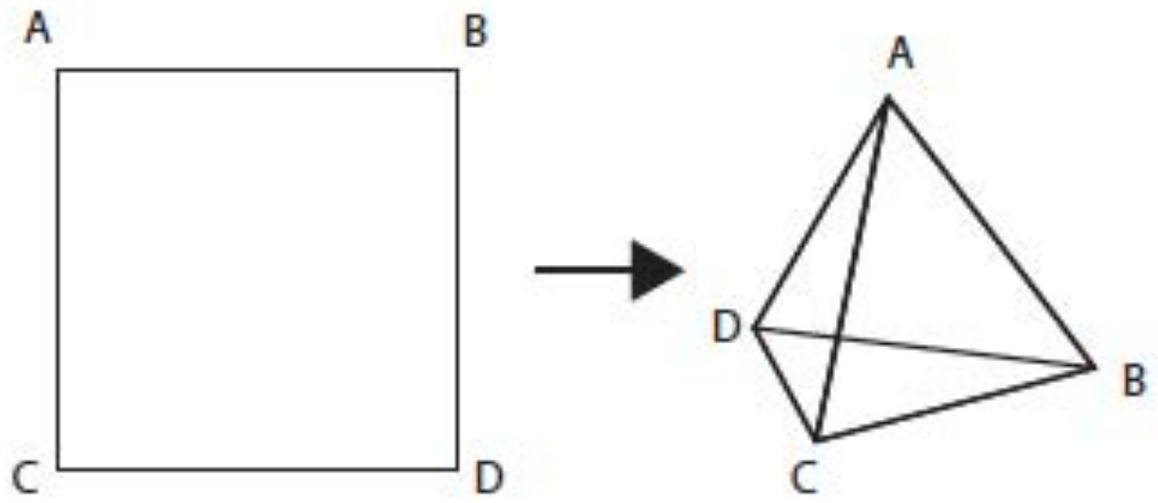


$a = \sqrt{1/8}$

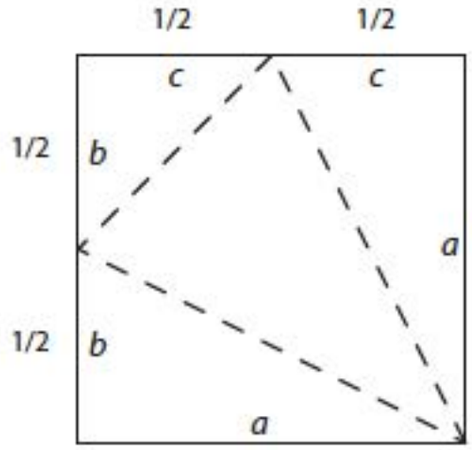
UNWRAPS

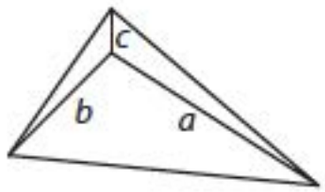


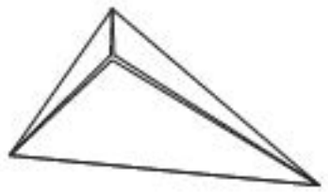
A SQUARE TO A TETRAHEDRON

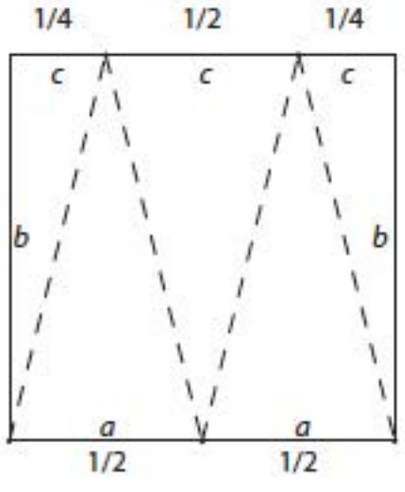


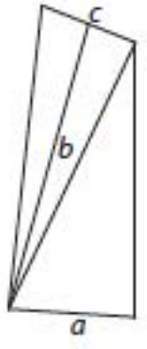
A SQUARE TO A TETRAHEDRON

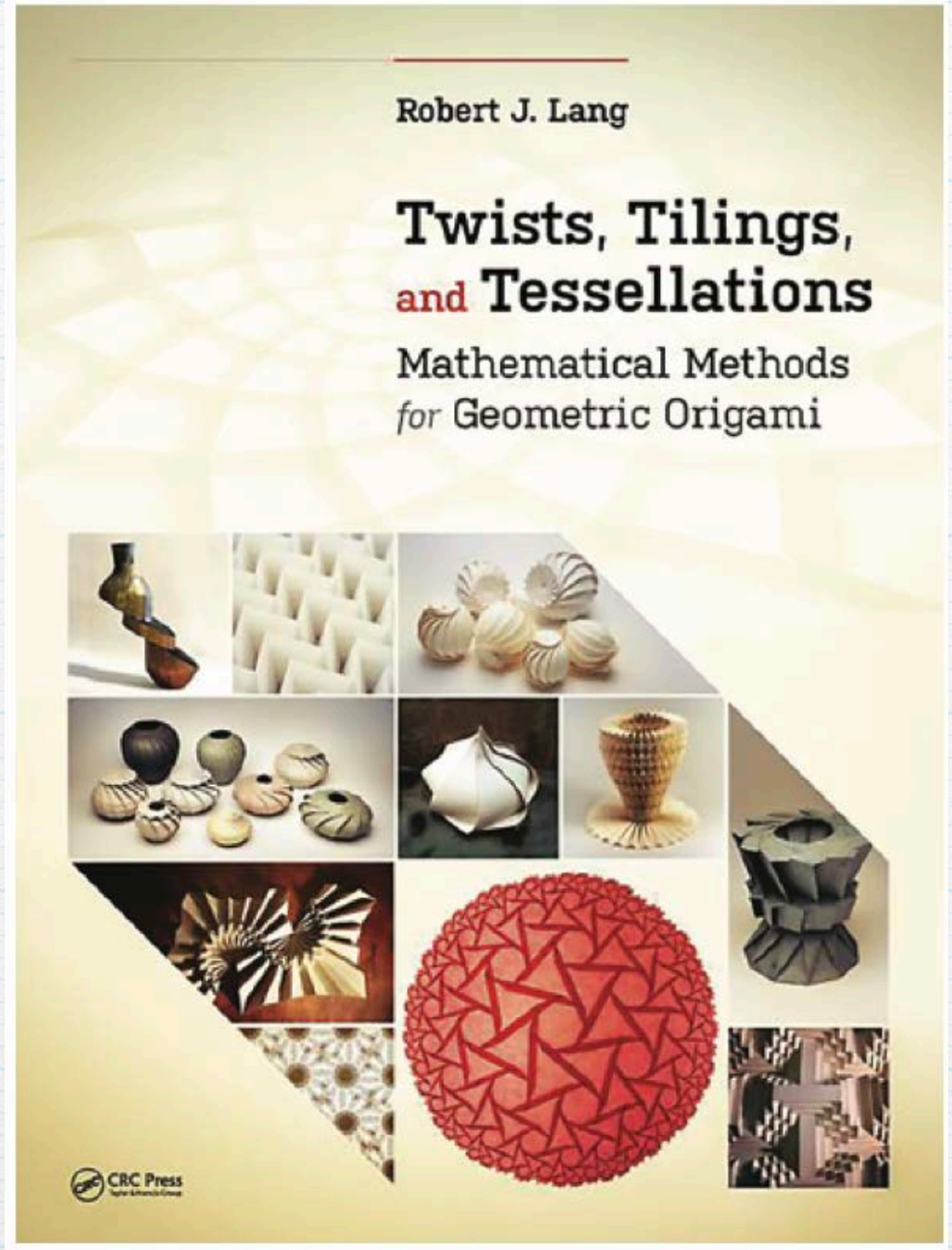








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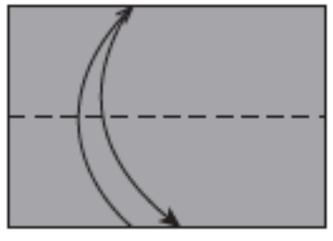
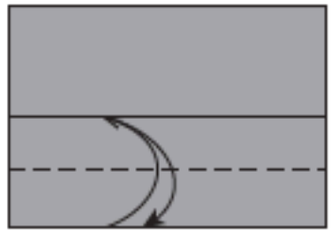
for Geometric Origami
CRC Press

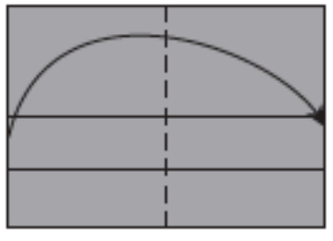
FOLD AND CUT STAR OF DAVID



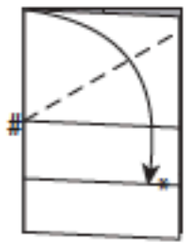
Fold bottom to top and unfold.



Fold the lower edge to the center line and unfold (to mark the quarter line).

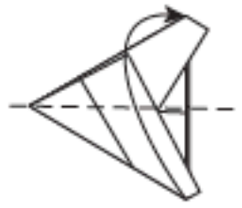


Fold in half from left to right.



Fold the upper left corner to the quarter line (*), and make sure the fold line starts at the (#) mark.

Fold the bottom left corner to the upper edge. A 60° angle is made!



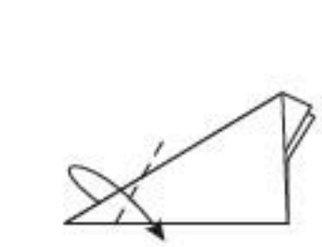
Fold in half with the bottom covering the top.

Cut along the thick line.

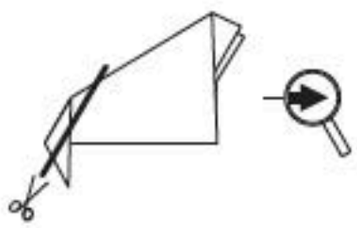
Unfold the left triangle.

A Star of David is formed!

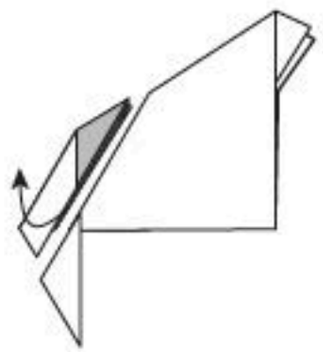
FOLD AND CUT STAR OF DAVID 2



Repeat the folding process of the previous solution. Add a valley fold as marked (at 60°).

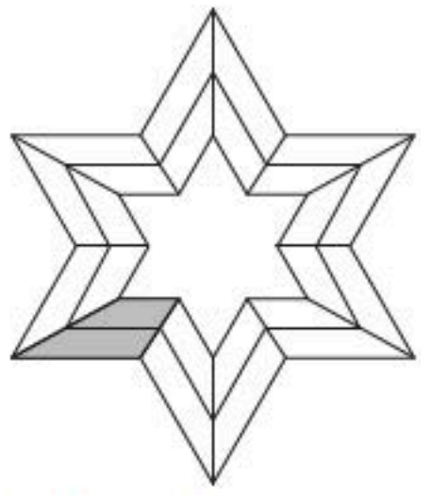


Cut along the thick line.



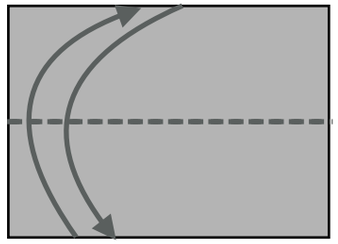
Unfold the left part (shaded in gray). Throw the rest away.

Unfold all.

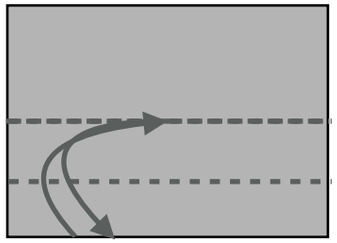


The hollow Star of David.

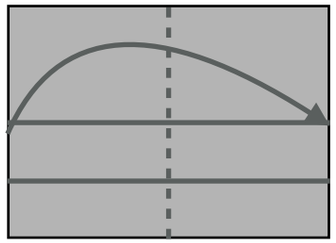
FOLD AND CUT STAR OF DAVID 3



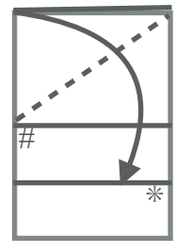
Fold bottom to top and unfold.



Fold the lower edge to the center line and and unfold (to mark the quarter line).

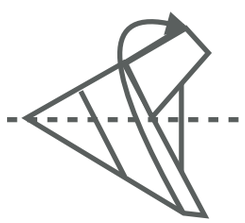


Fold in half from left to right.

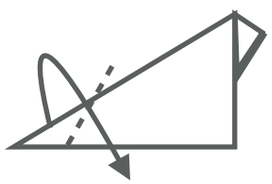


Fold the upper left corner to the quarter line (*) and makes sure the fold line starts at the (#) mark.

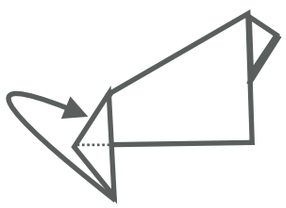
Fold the bottom left corner to the upper edge. A 60^0 angle is made.



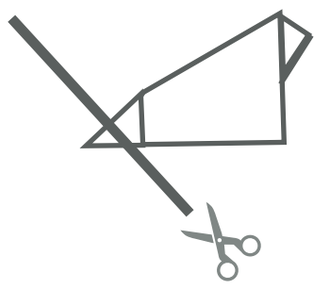
Fold in half with the bottom covering the top,



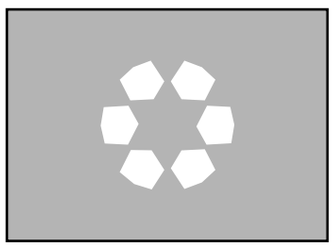
Make a 60^0 valley fold



Valley fold back the triangular wad of paper fold along its center line, so that it aligns with the bottom of the whole shape.



Cut along the thick line and unfold, discarding the small hexagonal pieces of paper



The result!