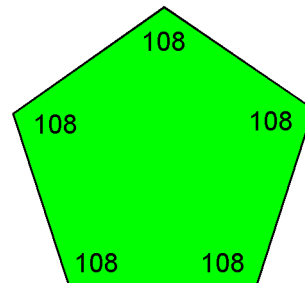# Pentagonal Tiles

These diagrams show you how to approximate pentagonal tiles from the silver rectangle and the square. A comparison of the angles of the resulting tiles can be found on pages 6 and 7. The tile folded from a square is a much more accurate approximation than the one folded from a silver rectangle but it is not as easy to fold.

Silver rectangles have edges in the proportion 1:sqrt2. DIN paper sizes such as A4, A5 etc are good enough approximations of silver rectangles for practical paperfolding purposes.

The first publication of the method for approximating a pentagon from a silver rectangle that I am aware of is in an article by Geoff Laming in the proceedings of the first Conference of Origami in Education and Therapy held in 1991. It is sometimes attributed to David Collier. I discovered the method for approximating a pentagon from a square in 1996.
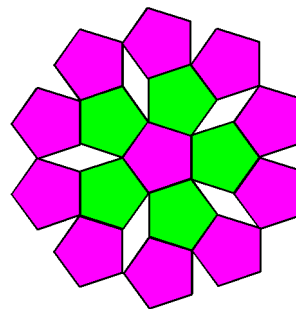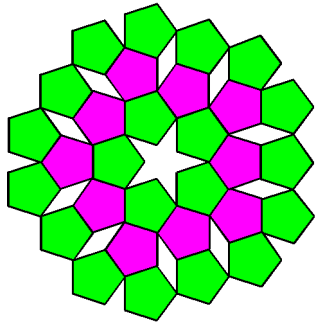
Tiling patterns

1

2
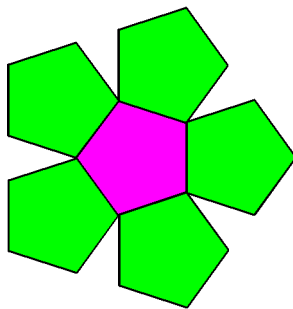
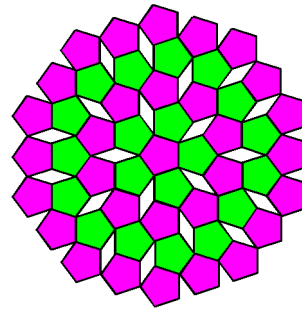1. Six regular pentagons will go together to form a pentagonal flower.

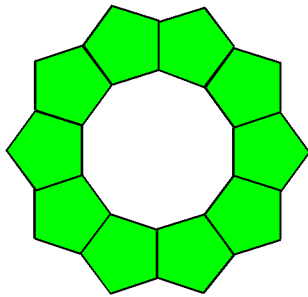2. A second layer of pentagons can be added around the edges of the flower.
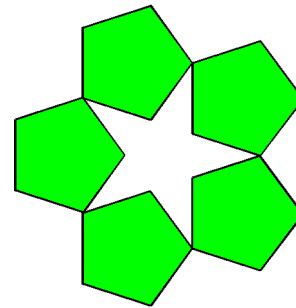
3

4

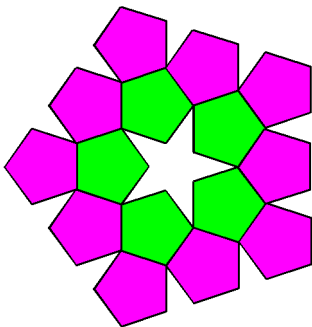3. This process can be continued ...

4. ... ad infinitum.

5

6

5. Ten regular pentagons will fit together to form a decagram ring surrounding a decagonal hole.
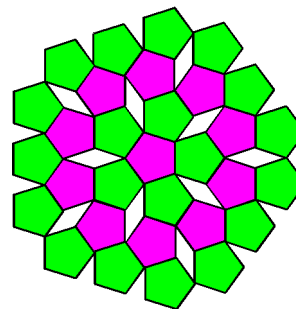
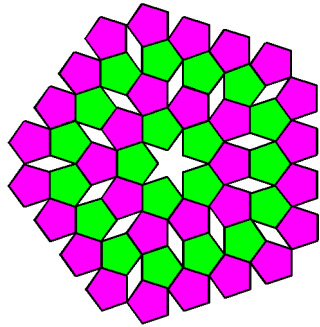6. Five pentagons can be arranged in a ring to leave a pentagram shaped hole in the centre.

7

8

7. Further concentric layers of pentagons can be added to the outside edges of this ring.
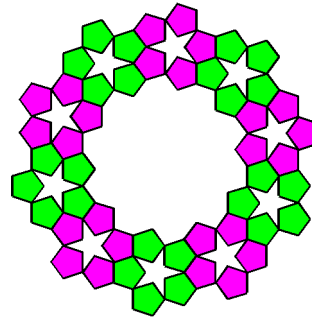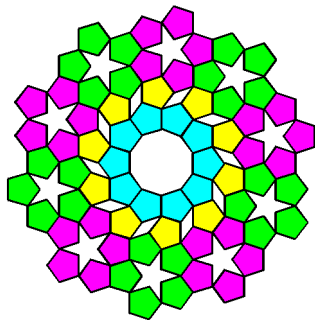
8. And this process too can be repeated ...

David Mitchell / Pentagonal Tiles

9

9. ... ad infinitum

10

10. Fifty pentagons can be arranged to form a ring of pentagrams.
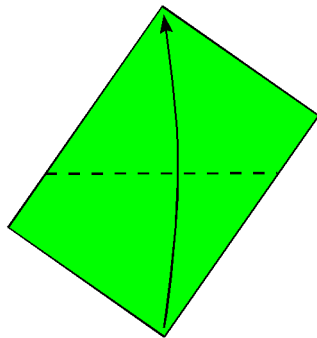
11

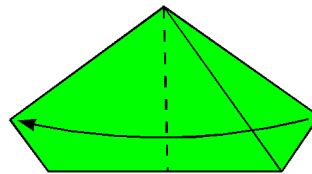11. The centre of the ring of pentagrams can be filled like this.

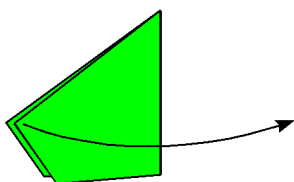# Folding pentagonal tiles from silver rectangles
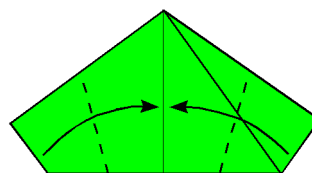
12

12. Fold in half diagonally upwards.
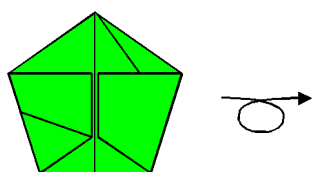
13

13. Fold in half sideways.

14

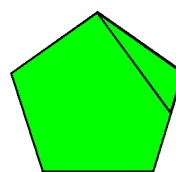14. Open out the fold made in step 13.

15

15. Fold both the sloping outside edges into the centre.

16

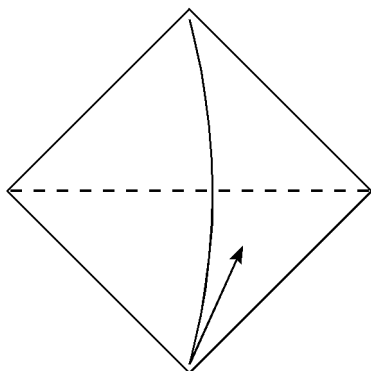16. Make sure all the layers lie flat then turn over sideways.

17

17. This pentagon is easy to fold but the angles are not very accurate. If you use it to make patterns you will need to make some allowance for these inaccuracies.
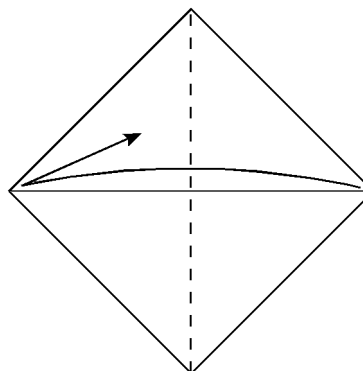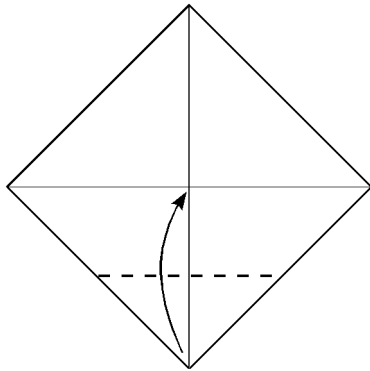
Folding pentagonal tiles from squares

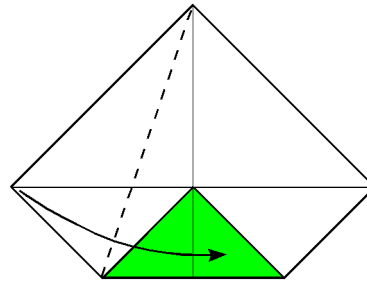**18**

18. Fold in half downwards, then unfold.

19

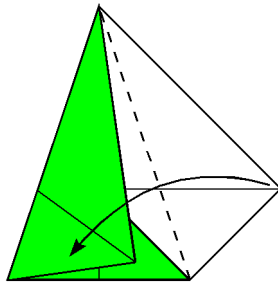19. Fold in half sideways, then unfold.

20

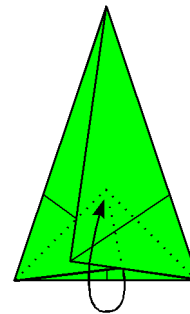20. Fold the bottom point into the centre.

21

21. Fold the left hand corner inwards like this. Make sure the top point and the bottom left corner both remain sharp.
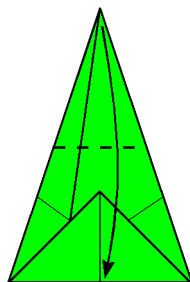
22

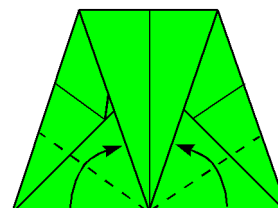22. Repeat fold 21 on the right hand side of the design.
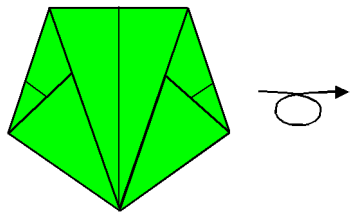
23

23. Pull out the hidden flap.

24

24. Fold the top point to the centre of the bottom edge.
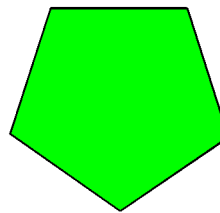
25

25. Fold both halves of the bottom edge inwards so that they butt to the edges of the front layer.

26

27

26. Make sure all the layers lie flat then turn over sideways.

27. The angles of this tile are not accurate. If you use it to make patterns you will need to make some allowance for these inaccuracies.

Comparing Approximated Angles

The internal angles of a regular pentagon should all be 108 degrees. While it is possible to construct an accurate regular pentagonal tile by folding paper it is far easier to fold reasonably good approximations.
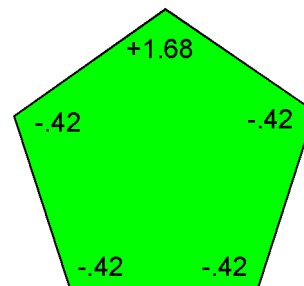
Tiles folded from silver rectangles

1

109.68

107.58   107.58

540

107.58   107.58

2

+1.68

-.42   -.42

-.42   -.42
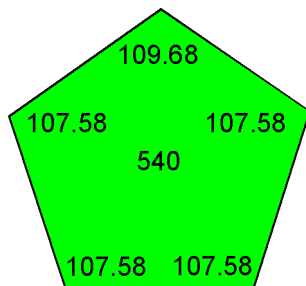
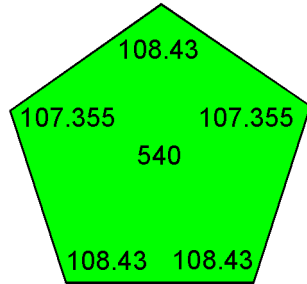1. This picture shows the internal angles of the pentagonal tile folded from a silver rectangle.

2. This picture shows the errors at each corner. You will see that the errors are concentrated in the top corner. The inaccuracies are counterbalanced by the fact that this pentagon is very easy to fold.
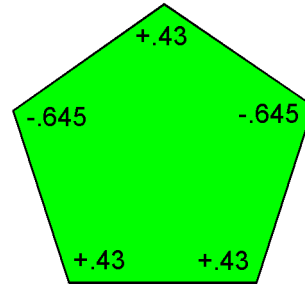
Tiles folded from squares

3

4

3. This picture shows the internal angles of the pentagonal tile folded from a square.

4. This picture shows the errors at each corner. You will see that the errors are distributed more evenly with this tile, with the result that this pentagon is, overall, a better approximation than the one folded from a silver rectangle. It is, however, slightly less easy to fold.