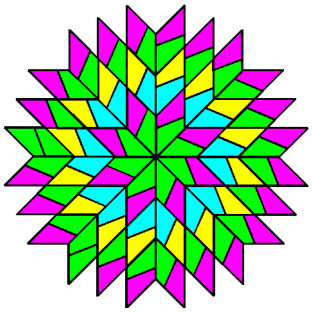
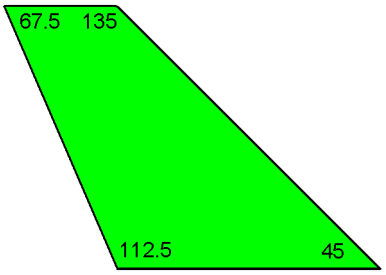
Versatiles

The Versatile is a variant of the octagon isosceles tile in the form of an irregular trapezium. These diagrams show you how to fold Versatiles from silver rectangles and squares.



When folded from a silver rectangle the Versatile is half the area of the rectangle it is folded from.

The Versatile is much easier to fold from a silver rectangle than from a square, although the square method is more interesting as origami.



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.

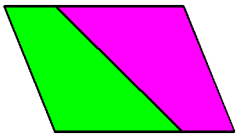
Because the Versatile is asymmetrical it is possible to fold mirror-image tiles either by making all the folds in the opposite direction (left instead of right or up instead of down) or by completely unfolding the tile and reversing the direction of all the creases.

As the name suggests, the Versatile is quite versatile when it comes to creating tiling patterns, both by itself and in combination with mirror-image tiles, or in combination with the octagon Isosceles tile. Two Versatiles will go together to form two different parallelograms. Both of these parallelograms can also be built, in numerous ways, by combining Versatiles with octagon isosceles tiles. This greatly extends the number of tiling patterns Versatiles can be used to create.

The Versatile from the silver rectangle is a design by Ian Harrison.
I designed the version from a square in 2010.

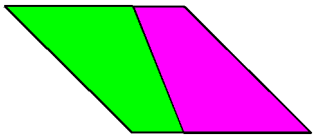
Tiling patterns

1



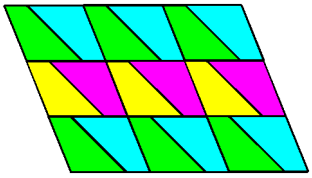
1. Two Versatiles will go together to form a parallelogram like this ...

2



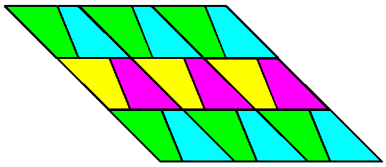
2. ... or a rhombus like this. (This rhombus is a compound octagonal rhombus tile.)

3



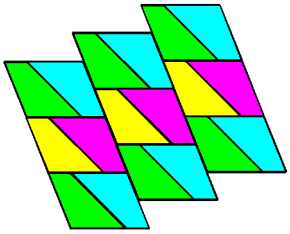
3. Versatile parallelograms will tile the plane.

4



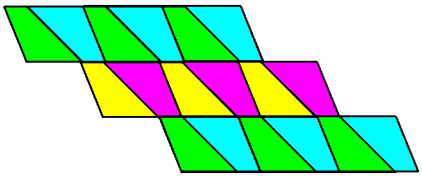
4. As will Versatile rhombuses (or rhombi).

5



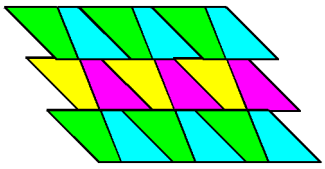
5. Columns of parallelograms can be displaced vertically like this ....

6



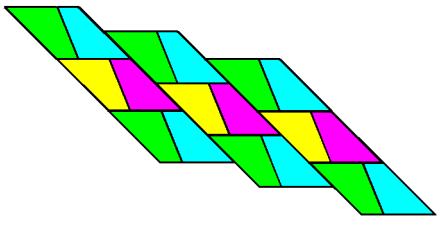
6. ... and rows of parallelograms horizontally, like this.

7



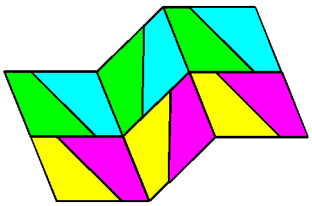
7. Rows of rhombi can also be displaced horizontally like this ...

8



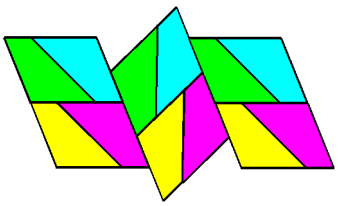
8. ... and columns of rhombi can be displaced diagonally like this.

9



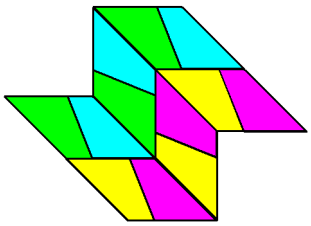
9. Parallelograms made from mirror-image tiles can be combined like this.

10



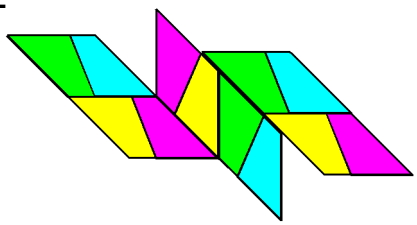
10. Columns of mirror-image parallelograms can be displaced vertically like this.

11



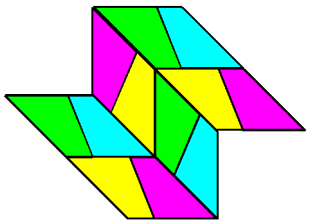
11. Rhombi can be combined in a similar way. The columns within this tiling pattern ...

12



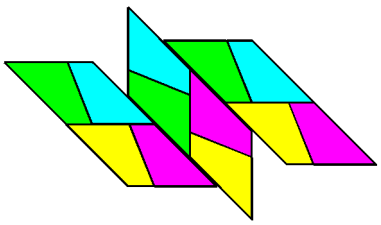
12. ... can be displaced diagonally like this.

13



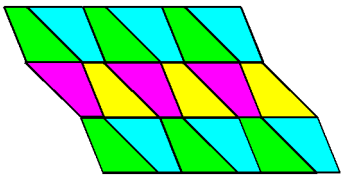
13. A similar pattern can be created by mixing rhombi made from mirror-image tiles. The columns in this tiling pattern ...

14



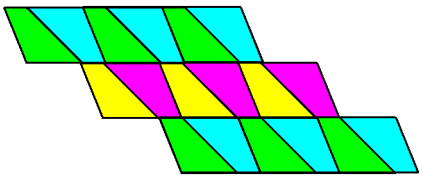
14. ... can be displaced diagonally as well.

15



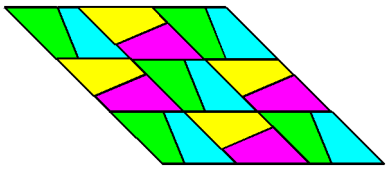
15. It is tempting to think that alternate rows of parallelograms and rhombi will create a new tiling pattern ...

16



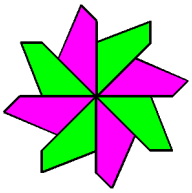
16. ... but in fact this is the same tiling pattern that we have already met in picture 6.

17



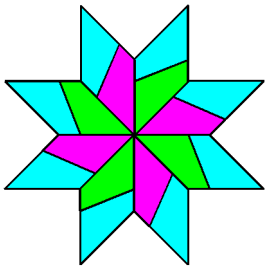
17. In fact, of course, because the two Versatile rhombus is symmetrical, mirror-image rhombi can be substituted for each other at any point within any of the patterns.

18



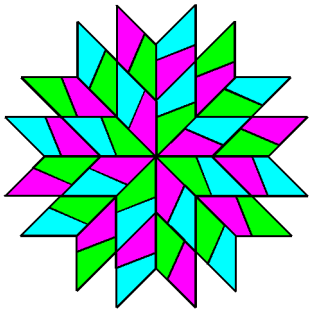
18. Eight Versatiles will go together to form a rotor ...

19



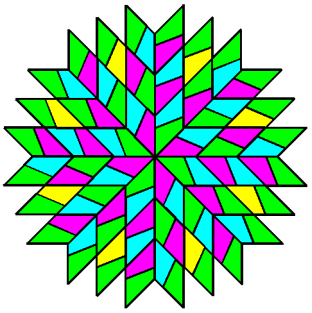
19. ... which can be filled to a star by adding further tiles.

20



20. The star can be expanded by adding a second ring of parallelograms.

21

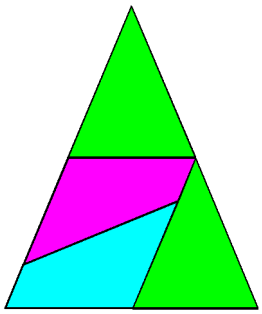


21. This process can be repeated ad infinitum.

Combination patterns

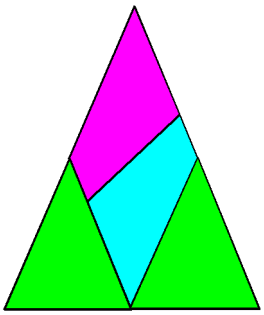
Versatiles can be combine with octagon Isosceles tiles to form many other patterns.

22



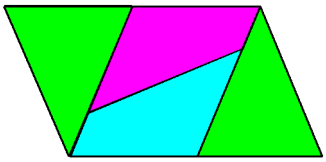
22. Compound isosceles tiles can be made like this ...

23



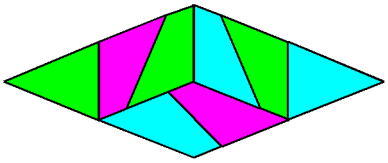
23. ... or like this.

24



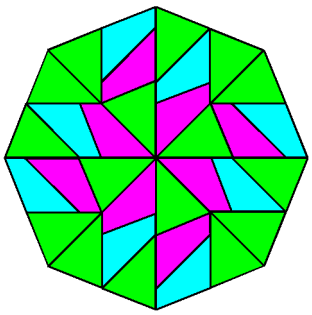
24. It is also possible to produce compound parallelograms ...

25



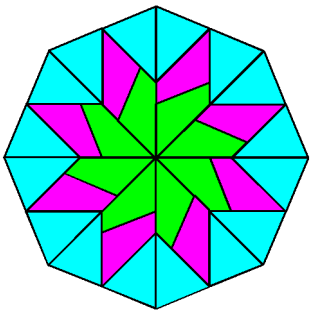
25. ... and rhombi, and, of course, to combine these rhombi in any of the patterns shown on pages 2, 3 and 4.

26



26. Compound isosceles tiles can be combine into octagons ...

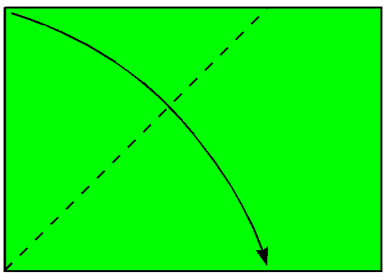
27



27. ... or any other of the tiling patterns shown on pages 31 and 32.

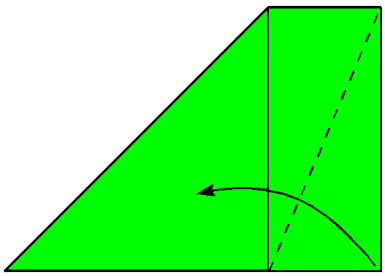
Folding Versatiles from a silver rectangle

28



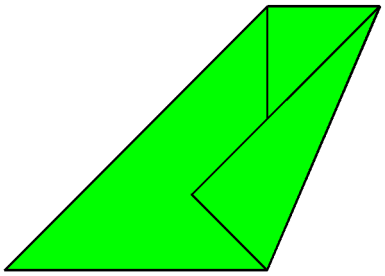
28. Fold the left hand edge onto the bottom edge.

29



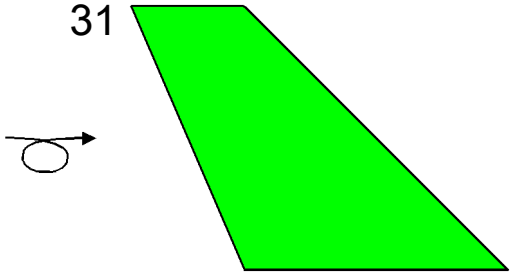
29. Fold the bottom right corner inwards so that the crease passes through the top right corner.

30



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

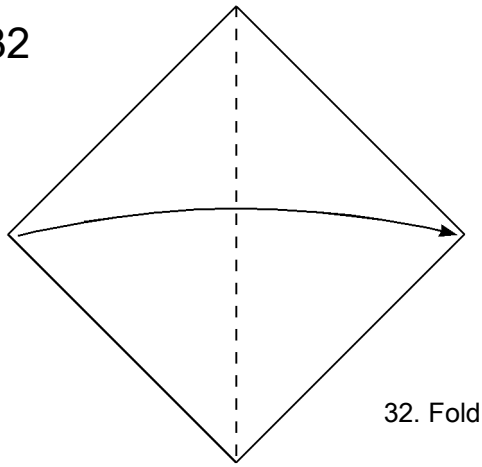
31



31. The Versatile is finished.

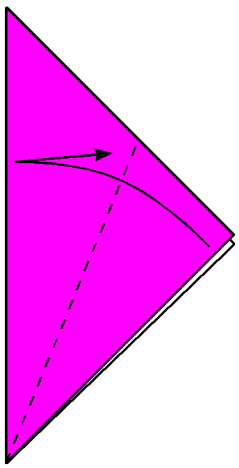
Folding Versatiles from a square

32



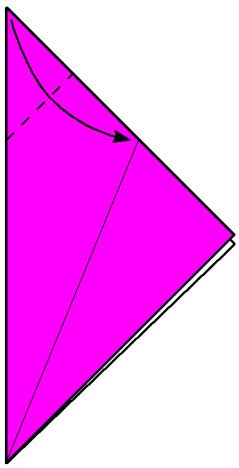
32. Fold in half sideways.

33



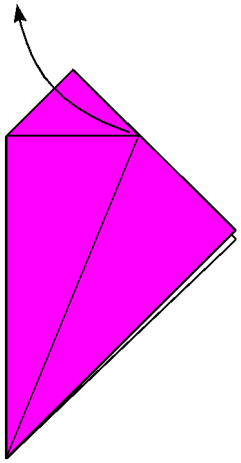
33. Fold the bottom right sloping edge onto the left edge, then unfold.

34



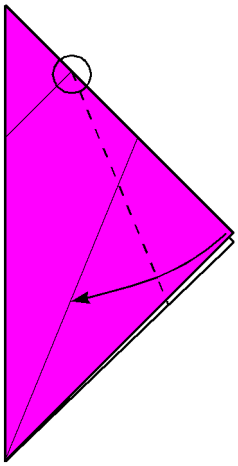
34. Fold the top point diagonally downwards to the point where the crease made in step 33 intersects the top right sloping edge.

35



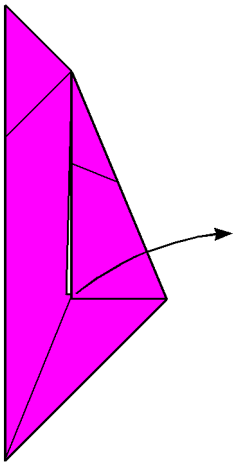
35. This is what the result should look like. Open out the fold made in step 34.

36



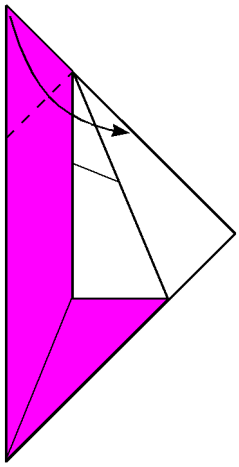
36. Fold the bottom part of the top right sloping edge of both layers inwards as shown, making sure that the new crease starts where the crease made in step 34 intersects the top right sloping edge (marked with a circle). The moving edge should end up vertical and parallel to the left edge. Picture 37 shows what the result should look like.

37



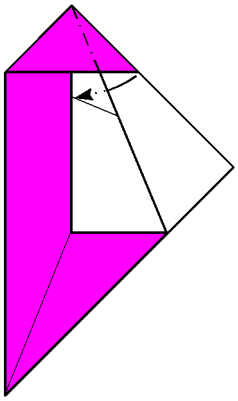
37. Check that the left edge of the front layers is parallel to the left edge of the layers behind. If necessary adjust the fold made in step 36 accordingly. Unfold just the front layer.

38



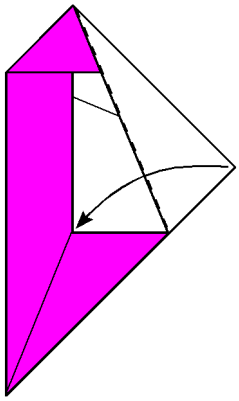
2. Fold the top point diagonally downwards using the crease made in step 34.

39



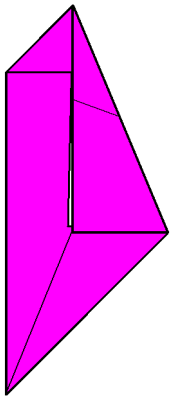
39. Fold the right point of the front layers backwards along the line of the folded edge immediately behind them so that it ends up hidden in between the other layers

40



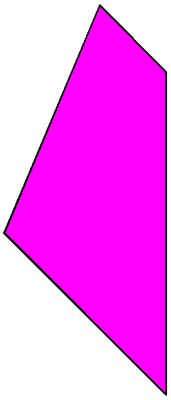
40. Fold the flap you opened out in step 37 back into place.

41



41. Make sure all the creases lie completely flat. Turn over sideways.

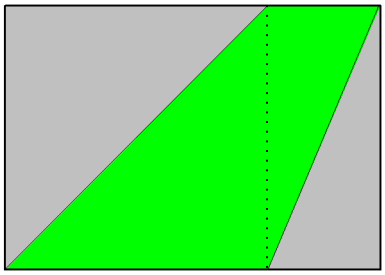
42



42. The Versatile is finished.

Notes

A



A. Adding a perpendicular makes it easy to see that the Versatile, like the octagon isosceles tile, is half the area of the silver rectangle it is folded from.