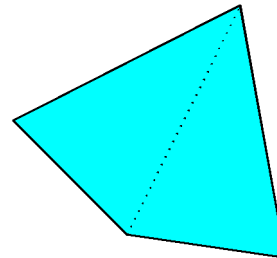


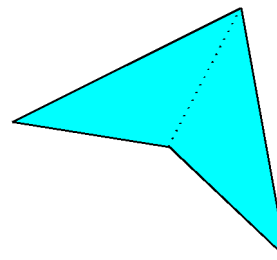
# Penrose Kites and Darts

Designed by David Mitchell

These diagrams show you how to fold origami versions of Penrose kites and darts from 2x1 rectangles using mock platinum folding geometry. 2 x 1 rectangles can easily be made by cutting squares in half.



Penrose kites and darts will combine to form periodic tiling patterns, or non-periodic patterns if the rule that the creases made in step 17 must always be aligned to form pentagons is introduced.

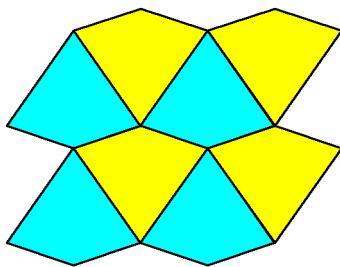


When constructing a non-periodic tiling pattern some allowance needs to be made for the slight inaccuracies of the folding geometry used.

These tiles were designed in 2000.

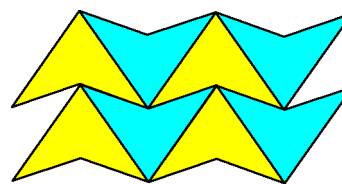
## Tiling patterns

1



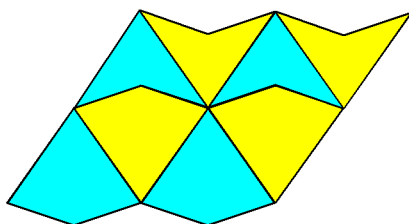
1. Rows of kites will fit together.

2



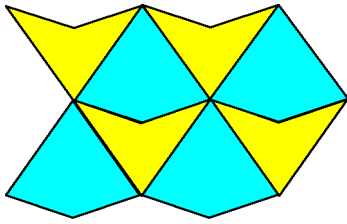
2. So will rows of darts.

3



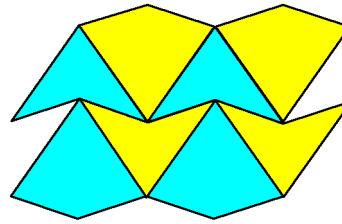
3. Rows of kites and rows of darts will fit together as well.

4



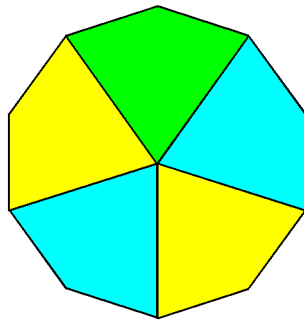
4. Rows made of alternate kites and darts will fit together like this ...

5



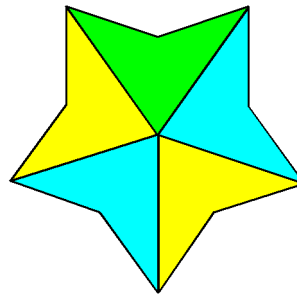
5. ... or this. All of these combinations will tile the plane.

6



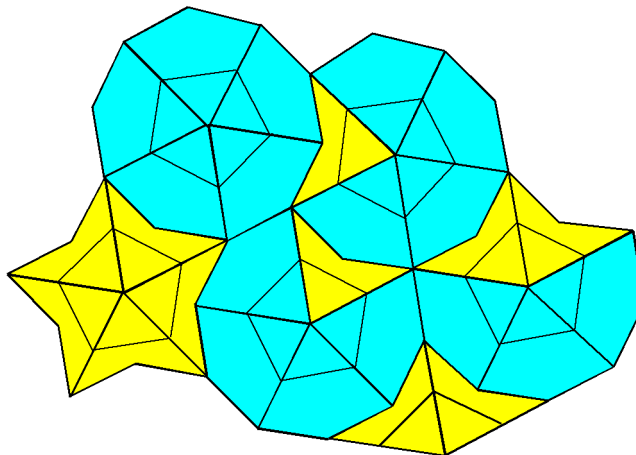
6. Five kites will form a decagon.

7



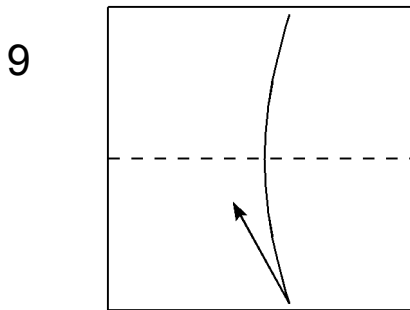
7. And five kites a stubby five-pointed star.

8

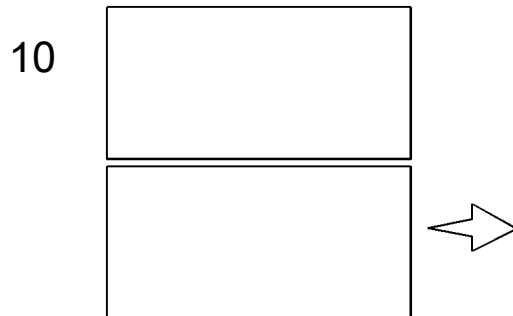


8. Kites and darts will also go together to form a non-periodic tiling pattern. Note that in order to build a tiling pattern of this kind it is necessary to arrange the creases made in step 17 so that they form complete regular pentagons.

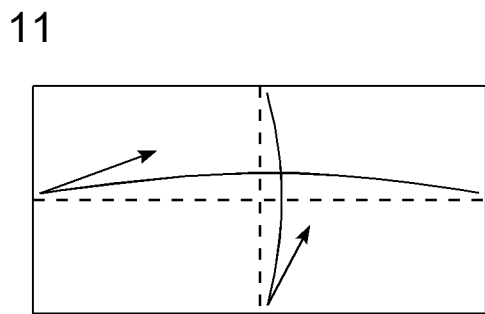
## Folding the kite



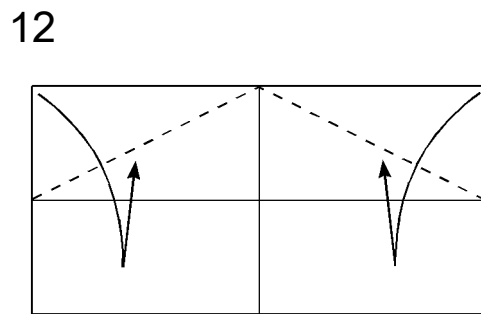
9. Fold in half downwards, then unfold.



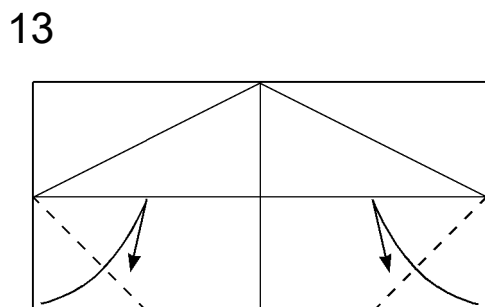
10. Cut along the crease made in step 9 to create two 2x1 rectangles.



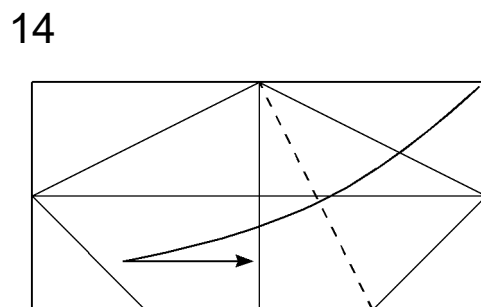
11. Fold one of the rectangles in half edge to edge both ways, then unfold.



12. Fold both top corners inwards like this, then unfold.

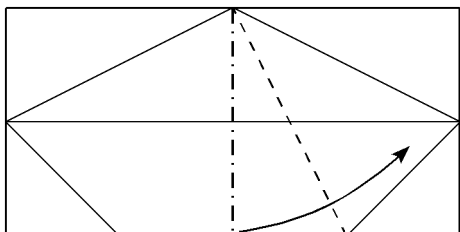


13. Fold both bottom corners inwards like this, then unfold.



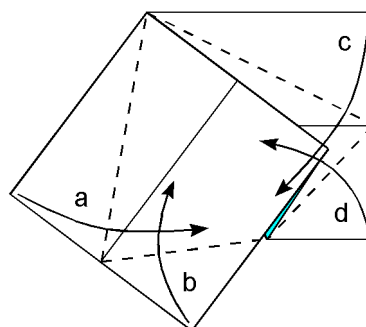
14. Fold the right hand edge onto the diagonal crease you have just made on the left side of the paper, then unfold.

15



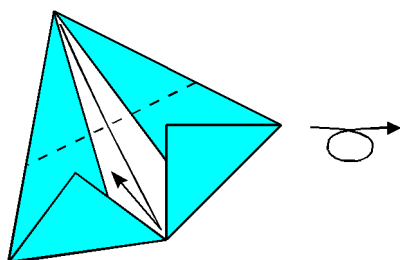
15. Pleat the paper using the sloping crease you have just made in step 14 and the vertical crease made in step 11.

16



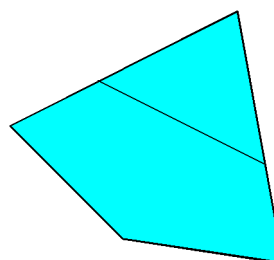
16. Make these folds in alphabetical order, using the existing creases.

17



17. Fold in half downwards like this, then unfold. Make sure all the layers lie flat then turn over sideways.

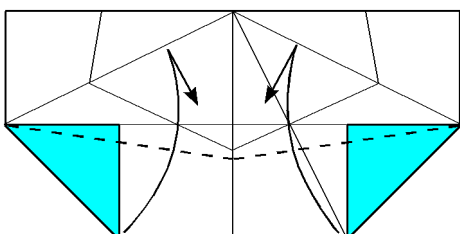
18



18. The Kite is finished.

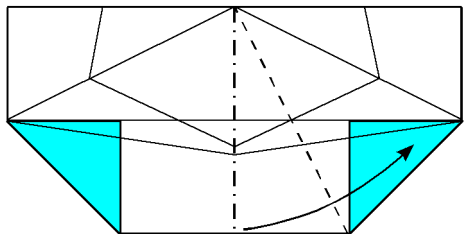
### Folding the dart

19



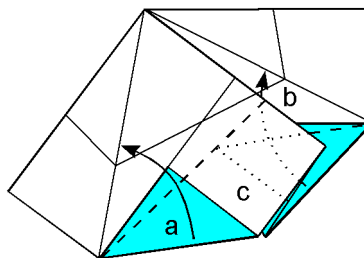
19. Begin with a completed Kite which has been unfolded to look like this. Fold the lower right sloping edge onto the crease made in step 12 and crease half way across the paper. Open out this fold then repeat on the left hand side.

20



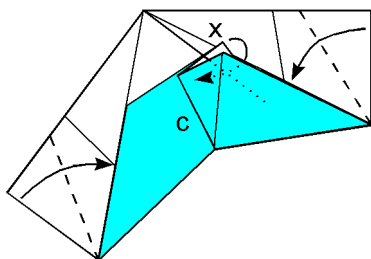
20. Remake fold 15.

21



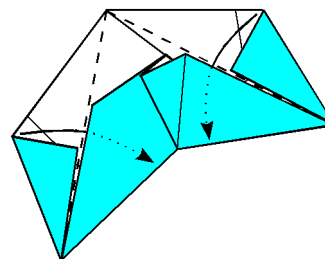
21. Make fold a then fold b using the creases made in fold 19. Crease c will form as the paper is flattened. The result should look like picture 22.

22



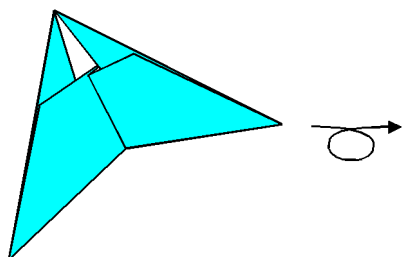
22. Fold flap x backwards into the pocket behind it to hold the layers together.

23



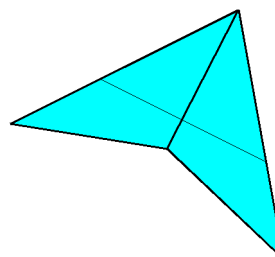
23. Fold both outside flaps into the pockets like this.

24



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

25



25. The Dart is finished.