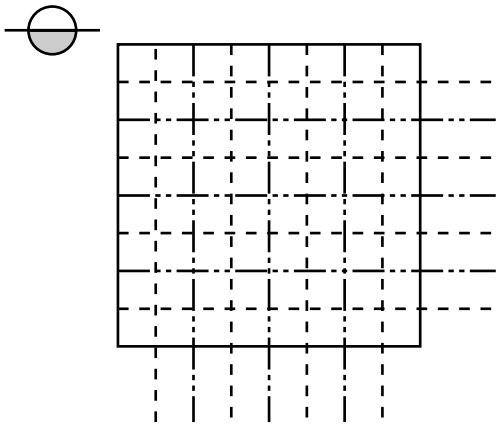
How to fold Box Pleated CPs

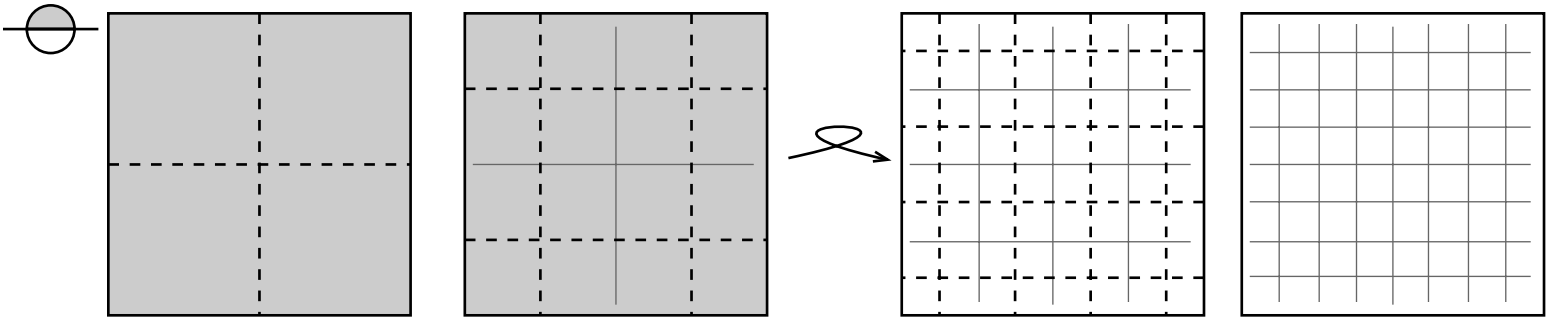
Part II - Precreasing

The first step in precreasing for a box pleated CP is do precrease the whole grid. This might not be necessary for all models but in general it is easier to prefold all creases instead of determining which creases are necessary.
What we need to know first is the size of the grid, so (if this information is not given along with the CP) we'll just have to count the number units across one side of the CP.
For my Porcupine model the grid is 32 x 32 units.

The creases will be alternating valley and mountain folds. When you are using duo-colour paper, with the colour-side down the outermost creases have to be valley folds for a coloured model. The next picture shows this for an 8 x 8 units grid.



Now if the grid size is of the form 2^n, like 32 for my Porcupine, the precreasing is quite trivial. Let's look at how to fold an 8 x 8 grid as example.



Fold in half both ways.

Fold edges to the centre.

Add valley folds between the mountain creases.

Grid complete.

So for divisions of 2, 4, 6, 16, 32, 64 etc. the precreasing is easy to do. But what are we supposed to do with divisions like 24, 40, 56, etc.
To solve this problem we first have to go back to elementary maths and make a prime factorization of the number we need.

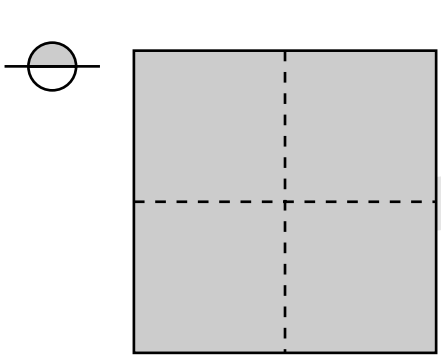
$$24 = 2*2*2*3$$
$$40 = 2*2*5$$
$$56 = 2*2*2*7$$

That means that for a 24 x 24 grid, we first need to divide the paper in thirds and then subdivide the thirds into eigths (2*2*2=8), which is easy once we have the thirds.

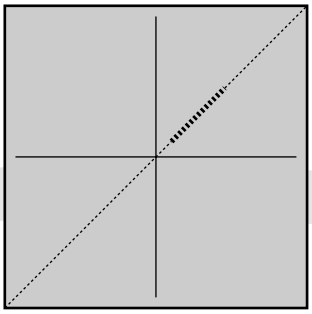
Guide by Gerwin Sturm (2007/01)
Porcupine 1.2 designed by Gerwin Sturm (2007/01/23)

To divide the paper into thirds we can use several different methods.
More information about these methods including the famous Haga theorems can be found at http://www.origami.gr.jp/People/CAGE_/divide/index-e.html

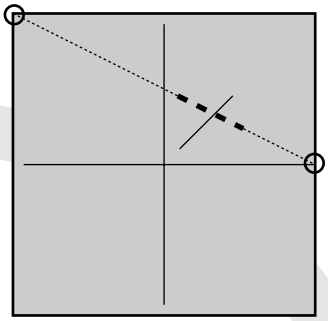
Here's the method I always use.



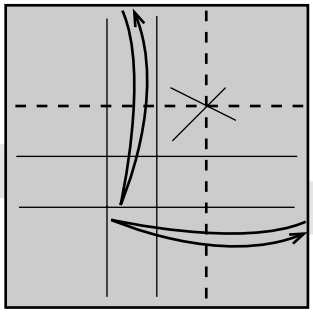
1. Fold in half both ways.



2. Precrease the diagonal but only where shown.

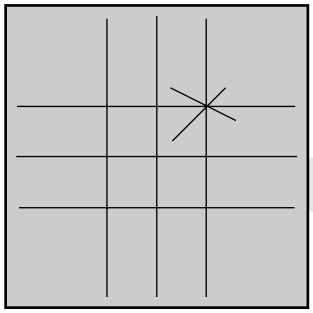


3. Fold between the shown points but only mark the intersection with the diagonal.



4. Fold the sides to the marked intersection and unfold.

5. Fold the two other sides to the creases made in step 4 and unfold.



6. Division into thirds done.

Now that we have thirds, all we have to do is the following:

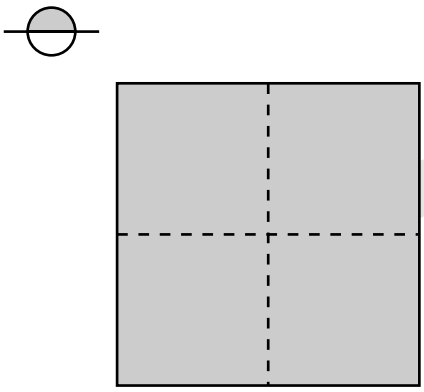
1. Add creases in the middle of the thirds to get sixths
2. Add creases between the sixths to get 12ths.
3. Turn the paper over.
4. Add creases between the 12ths to get the intended 24ths.

So in general (beware, some mathematics ahead) to get a grid of $2^{(n+1)}$*m units, with m being an odd number, first you have to make a grid of m x m units.
That's where the methods at http://www.origami.gr.jp/People/CAGE_/divide/index-e.html can help. I'll show you how to get some more divisions (the most common ones) on the next pages.

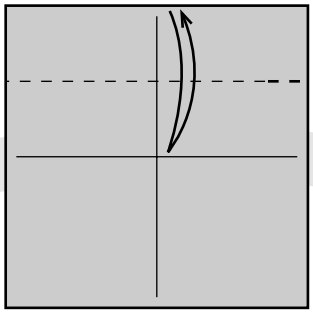
For the reference points in these methods you will mostly need halves, 4ths, 8ths and the like. In most cases you will need those creases for the CP anyway. If you don't need them just create them as pinches on the paper edge where they are needed.

Once you have the m x m grid, you only need to subdivide the division in half and in half again and so on until you have reached a 2^n*m division. All of the creases so far have been valley folds on the coloured side. Now you turn the paper over and subdivide in half a last time to get the final $2^{(n+1)}$*m grid.

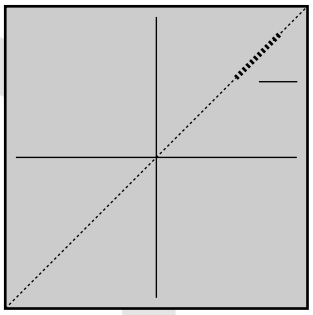
Here's one way to fold a 5 x 5 grid.



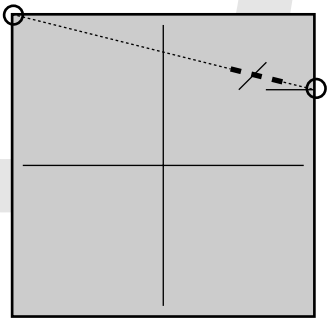
1. Fold in half both ways.



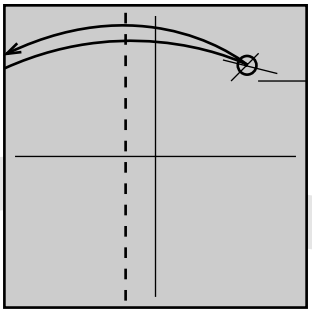
2. Fold the edge to the centre. Fold the whole crease or only pinch on the right depending on whether you need the crease in the CP or not.



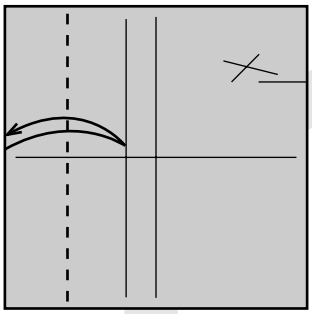
3. Precrease the diagonal but only where shown.



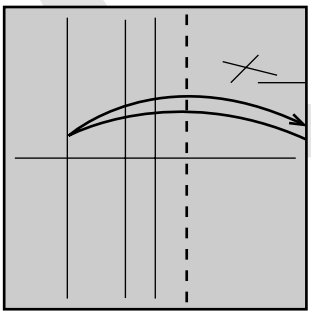
4. Fold between the shown points but only mark the intersection with the diagonal.



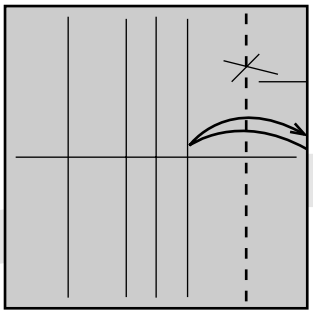
5. Fold the edge to the marked intersection and unfold.



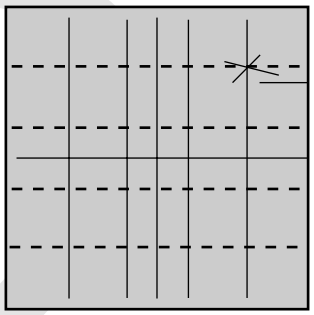
6. Fold the edge to the crease you just made and unfold.



7. Fold the edge to the crease you just made and unfold.

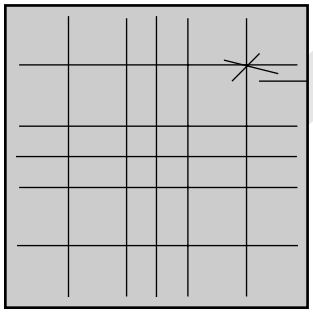


8. Fold the edge to the crease you just made and unfold.



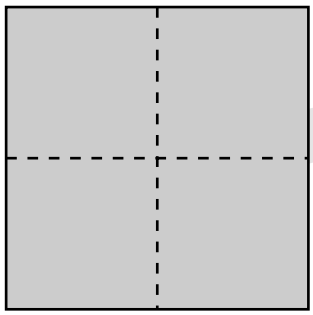
5-8

9. Repeat steps 5-8 horizontally.

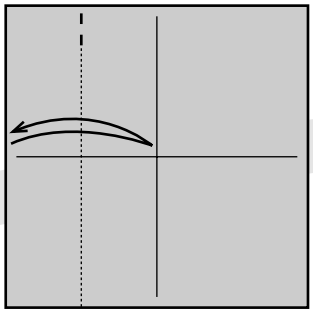


10. 5 x 5 grid done.

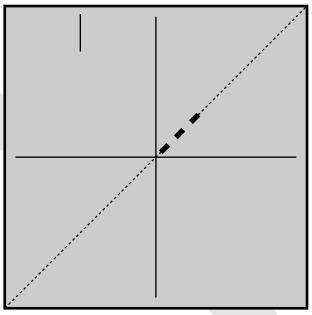
Here's one way to fold a 7 x 7 grid.



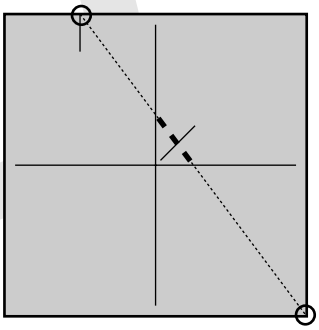
1. Fold in half both ways.



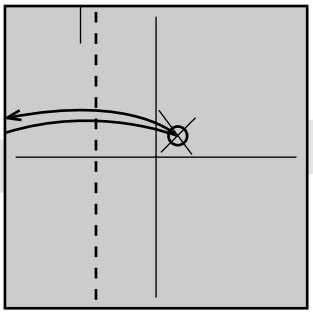
2. Fold the edge to the centre and unfold. Pinch or fold all as necessary.



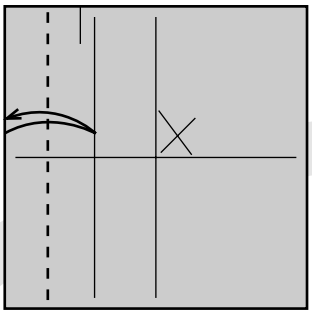
3. Precrease the diagonal but only where shown.



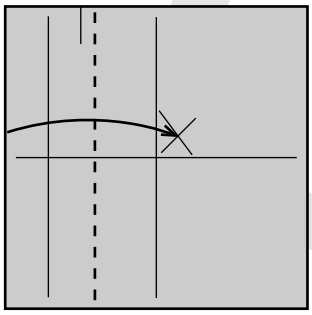
4. Fold between the shown points but only mark the intersection with the diagonal.



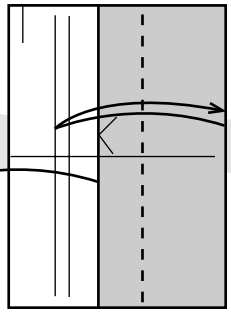
5. Fold the edge to the marked intersection and unfold.



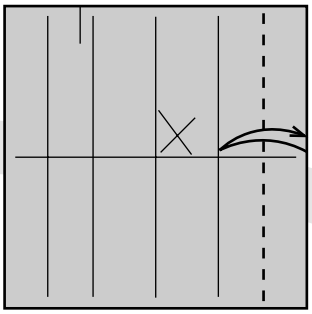
6. Fold edge to crease and unfold.



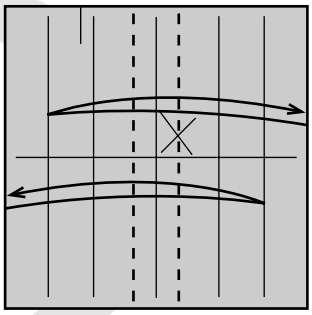
7. Fold over on exisiting crease.



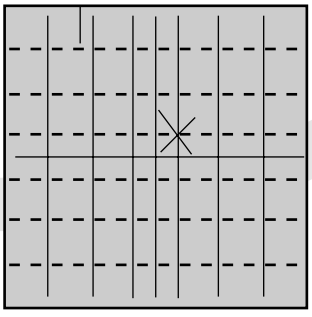
8. Fold edge to crease and unfold everything.



9. Fold edge to crease and unfold.

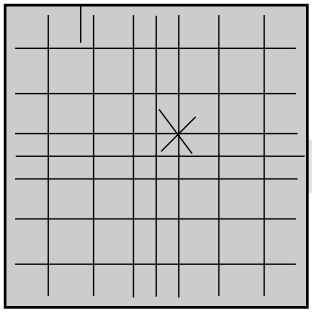


10. Fold and unfold as shown



5-10

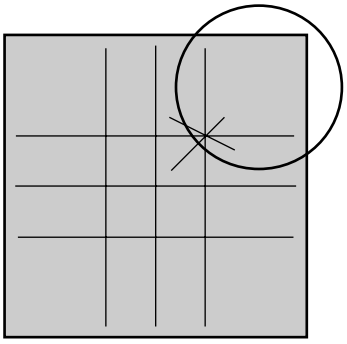
11. Repeat steps 5-10 horizontally.



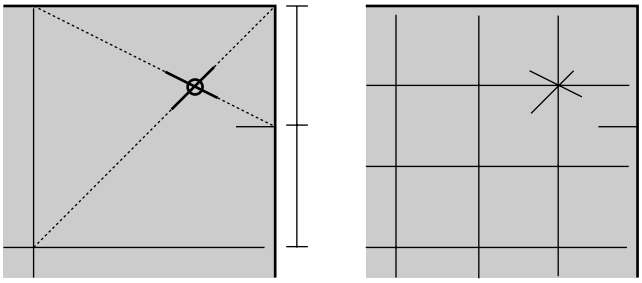
12. 7 x 7 grid done.

If you need a division like 9 (=3*3) or 15 = (3*5) or similar, you can either use one of the methods at http://www.origami.gr.jp/People/CAGE_/divide/index-e.html to give you this division directly or (f.e. if you don't have the tables for the methods at hand) use a recursive approach with the methods you already know. I'll give you an example of this with a 9 x 9 grid.

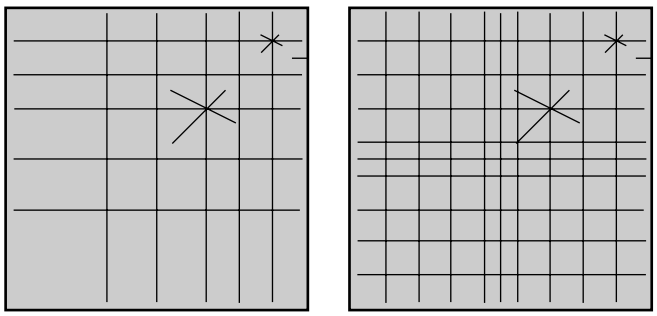
First divide the paper into thirds with the method from before. Then focus on the top right square.



You can use the exactly same method as before to divide this small square into thirds as well.



With the reference lines you now have, you can easily fold the rest of the 9 x 9 grid.



Now that you have the finished grid you have all the reference points you need to fold the diagonals shown in the CP. I usually make the diagonals as valley folds on the white side (mountain folds on the coloured side). But since you will need them both ways you can fold them any way you like.

With all the creases made we can now start the long and tedious collapsing process.