

Clock Tower Cardboard Model Plans 1

Laurence D. Finston

Created: May 17, 2010

Last updated: June 4, 2010

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Laurence D. Finston  
c/o Free Software Foundation, Inc.  
51 Franklin St, Fifth Floor  
Boston, MA 02110-1301  
USA

Email: [Laurence.Finston@gmx.de](mailto:Laurence.Finston@gmx.de)

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## Instructions

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Any corrections will be gratefully received by the author. Contact information can be found on the title page.

To use these plans, tape, tack or otherwise attach them to a sheet of heavy paper (I find tacking works best, where possible).

**PLEASE NOTE!** This version of these plans has tabs that are cut out together with the model (i.e., in one piece) are not suitable for use with cardboard or Bristol board! In this case, the thickness of the cardboard is significant and the parts won't match up properly. Instead, double tabs should be cut out and attached to each of the pieces that are to be connected. I plan to add a version of these plans with double tabs, but have not done so yet (as of 2010.05.17).

The crosshairs on the plans mark places where holes for stitches may be made. The model may then be sewn together or the stitches may be used to align the pieces when gluing.

A cutting knife should be used to cut out the *outer* lines of the plan and score the lines to be folded. Some inner lines, such as the traces of the tabs, are merely for reference and should not be scored.

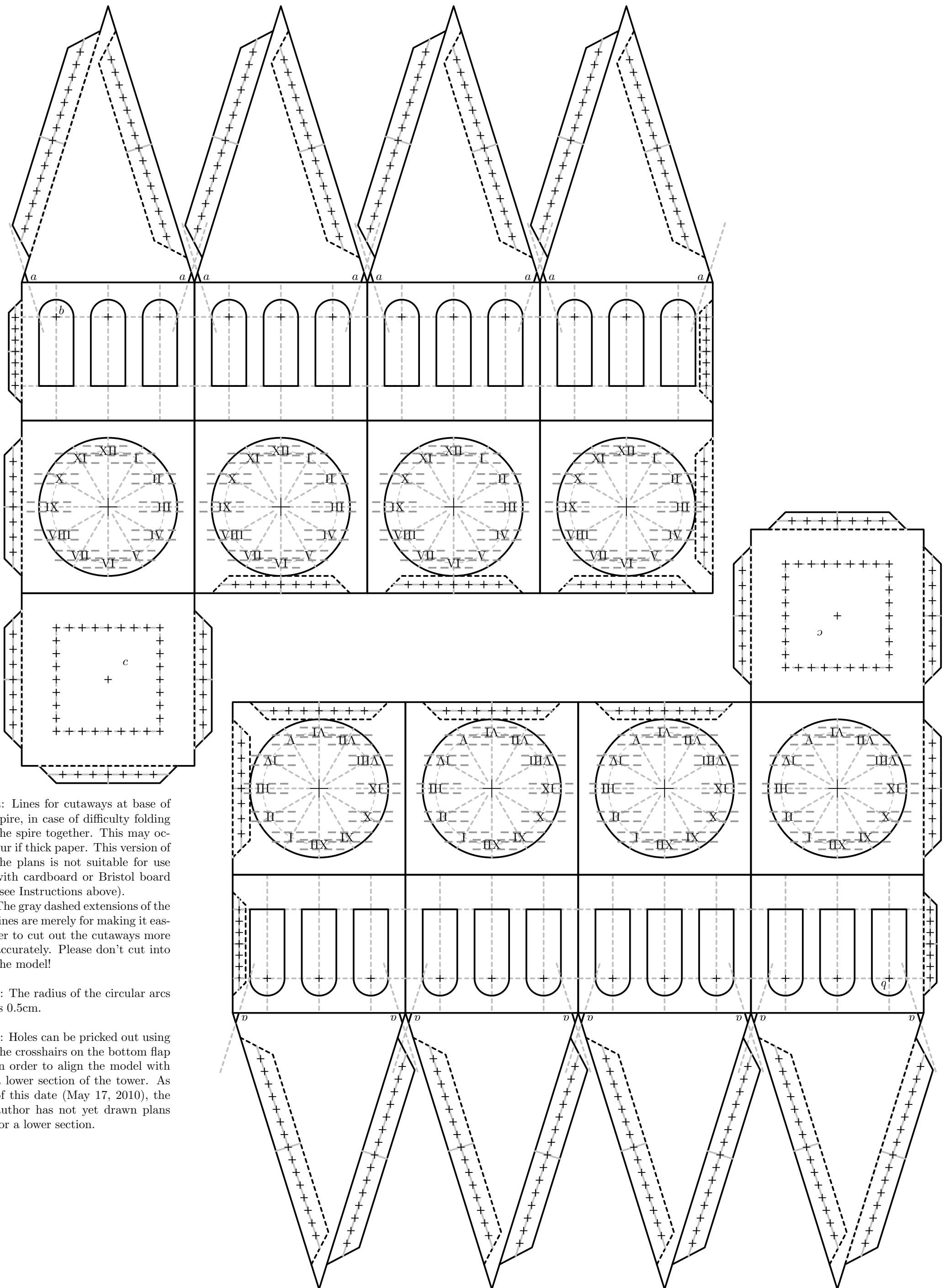
Lines to be cut are drawn in solid black while ones that should be scored or are merely for reference are dashed and/or drawn in gray. Crosshairs that mark where holes should be pricked are drawn in solid black, but with a smaller line width. Here too, I have tried to be consistent about this but cannot guarantee that there are no errors.

The knife must be sharp as heavy paper will dull the blade quickly. I have been using knives with disposable blades. I've been meaning to try sharpening them but haven't done so yet. I therefore can't say whether this will work. It seems a shame to waste so many blades, which is why I have a jar full of them. They must be good for something.

It will be necessary to reattach the plans to the paper as parts are cut out.

Please make sure that the plan is taped down smoothly or you will introduce inaccuracies. *Do not untape it or let it slip until you are done!* You will never get it back where it's supposed to go.

If you use tape, please use a removable kind. Ordinary masking tape will damage the paper when it is removed. Be aware that "removable tape" isn't completely reliable, especially if left too long on the drawing. Sometimes it's possible to reuse pieces of it, which avoids wasting large amounts of it.



*a:* Lines for cutaways at base of spire, in case of difficulty folding the spire together. This may occur if thick paper. This version of the plans is not suitable for use with cardboard or Bristol board (see Instructions above). The gray dashed extensions of the lines are merely for making it easier to cut out the cutaways more accurately. Please don't cut into the model!

*b:* The radius of the circular arcs is 0.5cm.

*c:* Holes can be pricked out using the crosshairs on the bottom flap in order to align the model with a lower section of the tower. As of this date (May 17, 2010), the author has not yet drawn plans for a lower section.

## Dodecahedron With Sundial Faces 1

Laurence D. Finston

Created: November 8, 2007

Last updated: November 8, 2007

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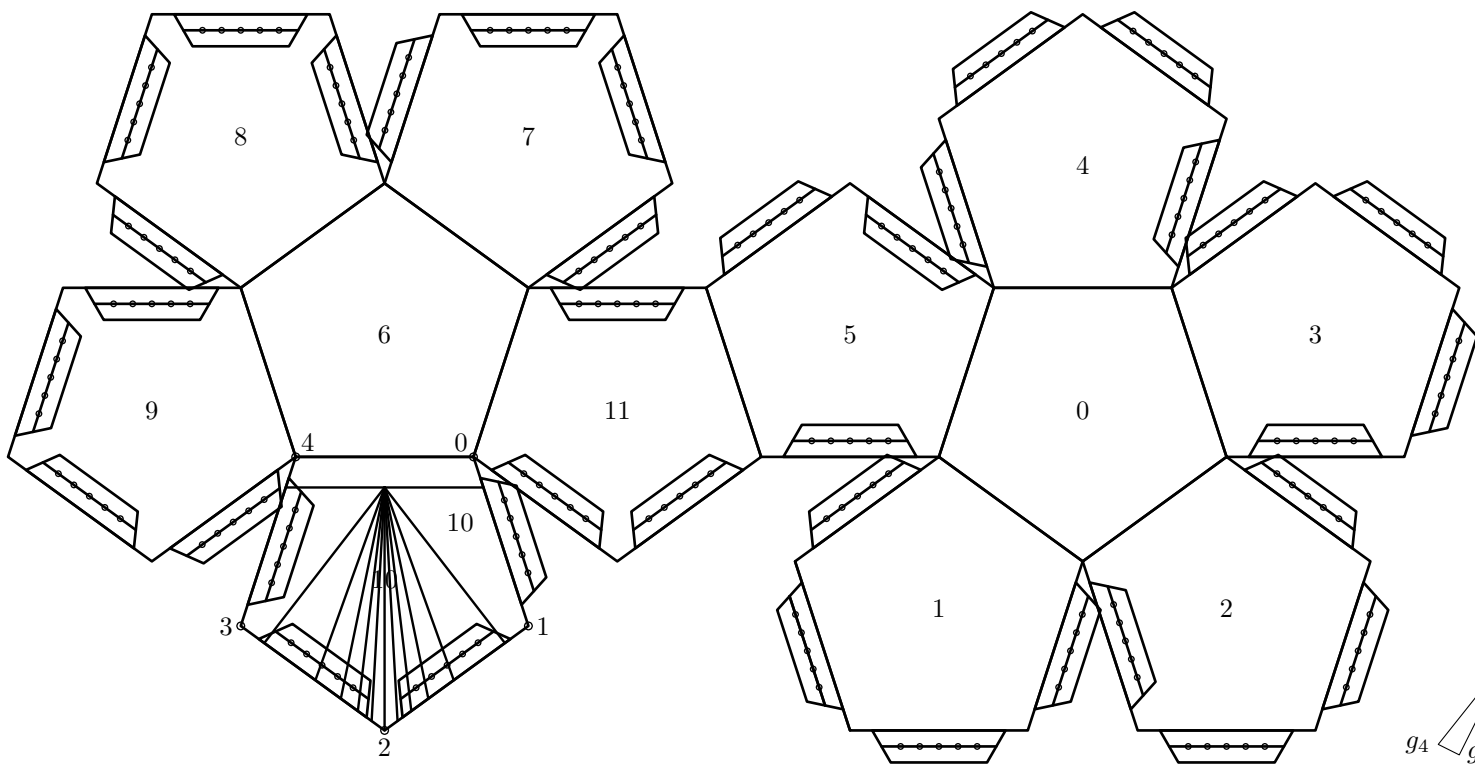
[Laurence.Finston@gmx.de](mailto:Laurence.Finston@gmx.de)

## Instructions

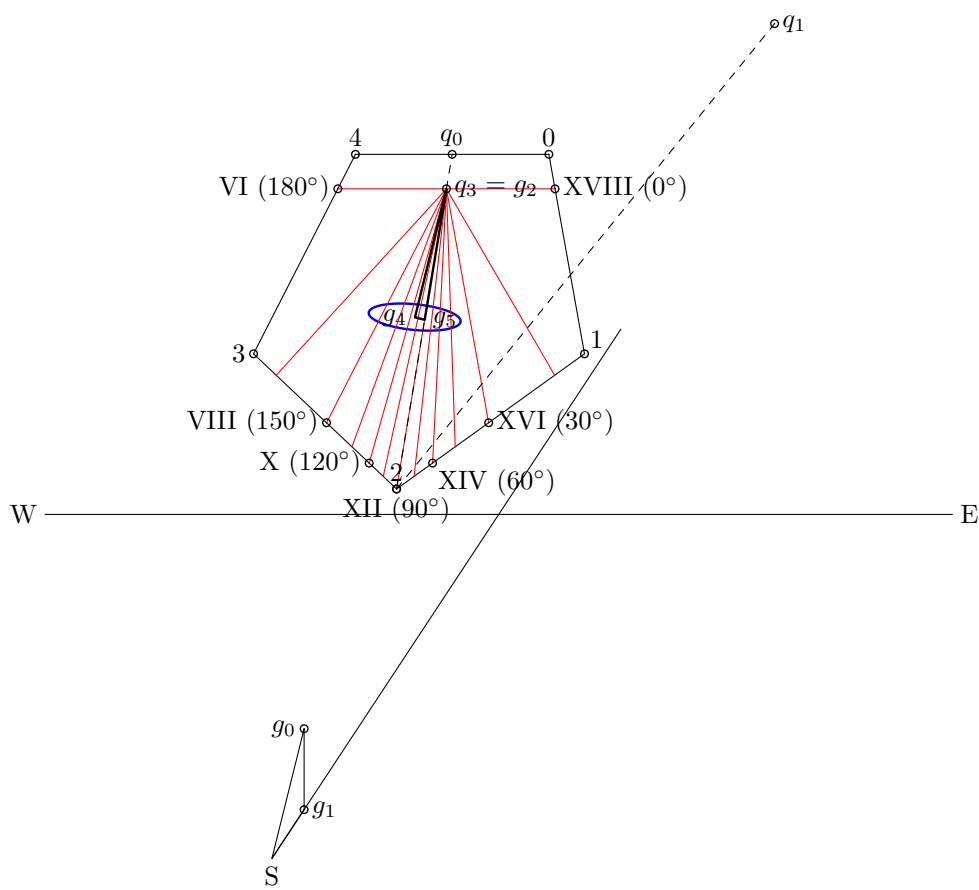
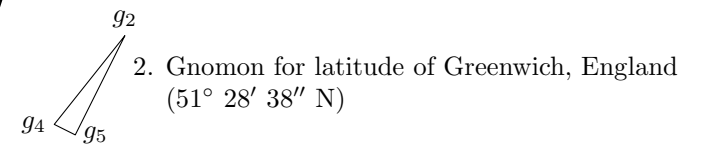
**PLEASE NOTE!** These plans are incomplete, so you probably don't want to use them anyway. They are for purposes of illustration only. However, if you feel you must ...

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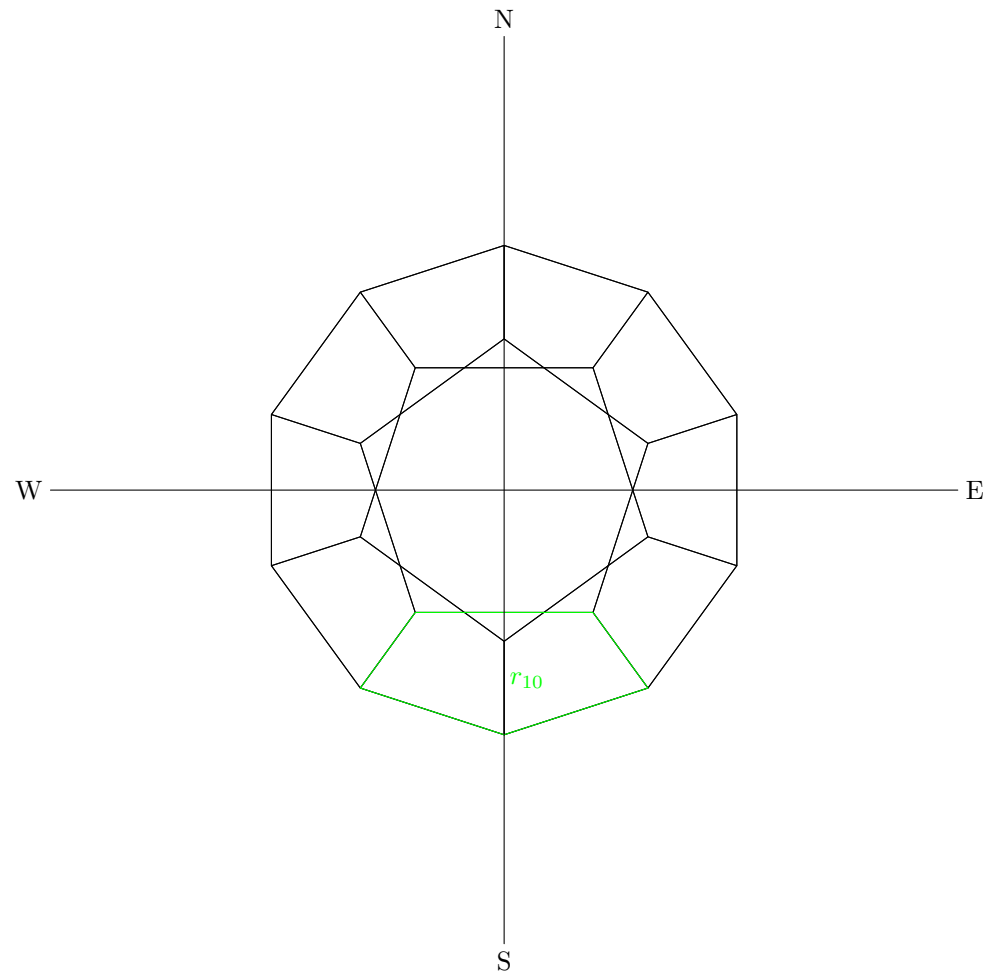
General instructions are available on the following webpage:  
[http://www.gnu.org/software/3dldf/polymod1.html#General\\_Instructions](http://www.gnu.org/software/3dldf/polymod1.html#General_Instructions)



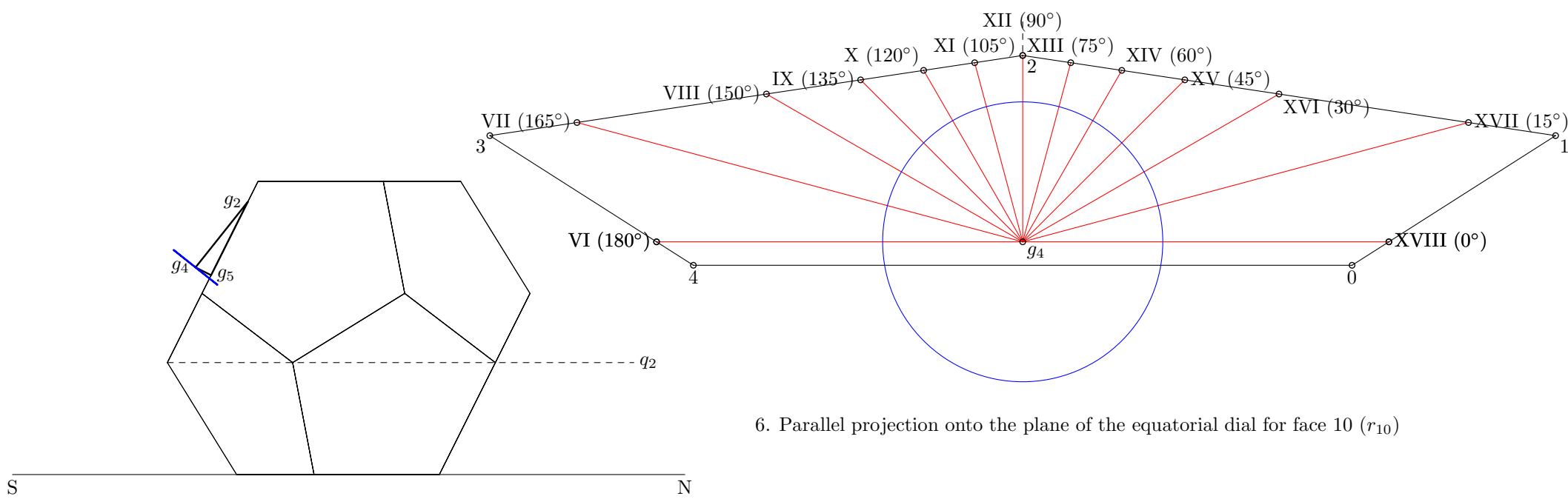
1. Net with hour lines on face 10



3. Perspective view. Focus position: (7cm, 8cm, -20cm), focus direction: (7cm, 8cm, 10cm), distance to plane of projection: 20cm.



4. Parallel projection,  $xz$  plane



5. Parallel projection, plane perpendicular to face 10 ( $r_{10}$ )

6. Parallel projection onto the plane of the equatorial dial for face 10 ( $r_{10}$ )

Laurence D. Finston

Created: January 22, 2009

Last updated: January 23, 2009

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## Instructions

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Any corrections will be gratefully received by the author. Contact information can be found on the title page.

To use these plans, tape or otherwise attach them to a sheet of Bristol board or heavy paper. Then use a cutting knife to cut the *outer* and *score* the inner lines of the plan. **Please note**, however, that the traces of the tabs and the dotted lines with larger dots within the polygons should not be scored! The knife must be sharp as Bristol board will dull the blade quickly.

The large dots show where holes should be poked for stitches. The latter are meant to be used for aligning each pair of sections of the model where they attach to each other. It is intended that the stitches only be used for alignment and that the model be glued together. However, the stitches may suffice. I haven't tested this, though. On this model, I am trying a double row of stitches for each tab. I haven't tested this yet, either.

I have been using knives with disposable blades. I've been meaning to try sharpening them but haven't done so yet. I therefore can't say whether this will work. It seems a shame to waste so many blades, which is why I have a jar full of them. They must be good for something.

It will be necessary to retape as bits of the plan are cut out.

Make sure that the plan is taped down smoothly or you will introduce inaccuracies. *Do not untape it or let it slip until you are done!* You will never get it back where it's supposed to go. However, it is possible to start again, make another portion of the plan and attach the pieces. There's no real need to make the net in one piece.

Use removable tape. Ordinary masking tape will damage the paper layer of the Bristol board when it is removed. Be aware that “removable tape” isn't completely reliable, especially if left too long on the drawing. Sometimes it's possible to reuse pieces of it, which avoids wasting large amounts of it.

The sides of faces without tabs have a “trace” of a tab on them, indicating where the tab will lie under it. The dots on the lines through the middle of the tabs and their traces (lengthwise) indicate positions where holes can be made for sewing the model together. This will only be necessary for the last faces, where there's not enough room to fit one's fingers inside the model.

Holes can be made using a needle, if the cardboard isn't too thick. A small tack or brad can be driven through thicker cardboard.

Some of the polygons on the net are so close together, that there is no room to print an outer tab. In this case, both the polygons in a pair have a tab trace. Next to the net, I have printed double tabs which are to be punched, cut out and attached to the inner tabs of these polygons.

After the glue has hardened, stitches can be picked out and the ends snipped off. If paper is to be glued onto the faces (e.g., watercolor paper), it may not be necessary to remove every last trace of thread.

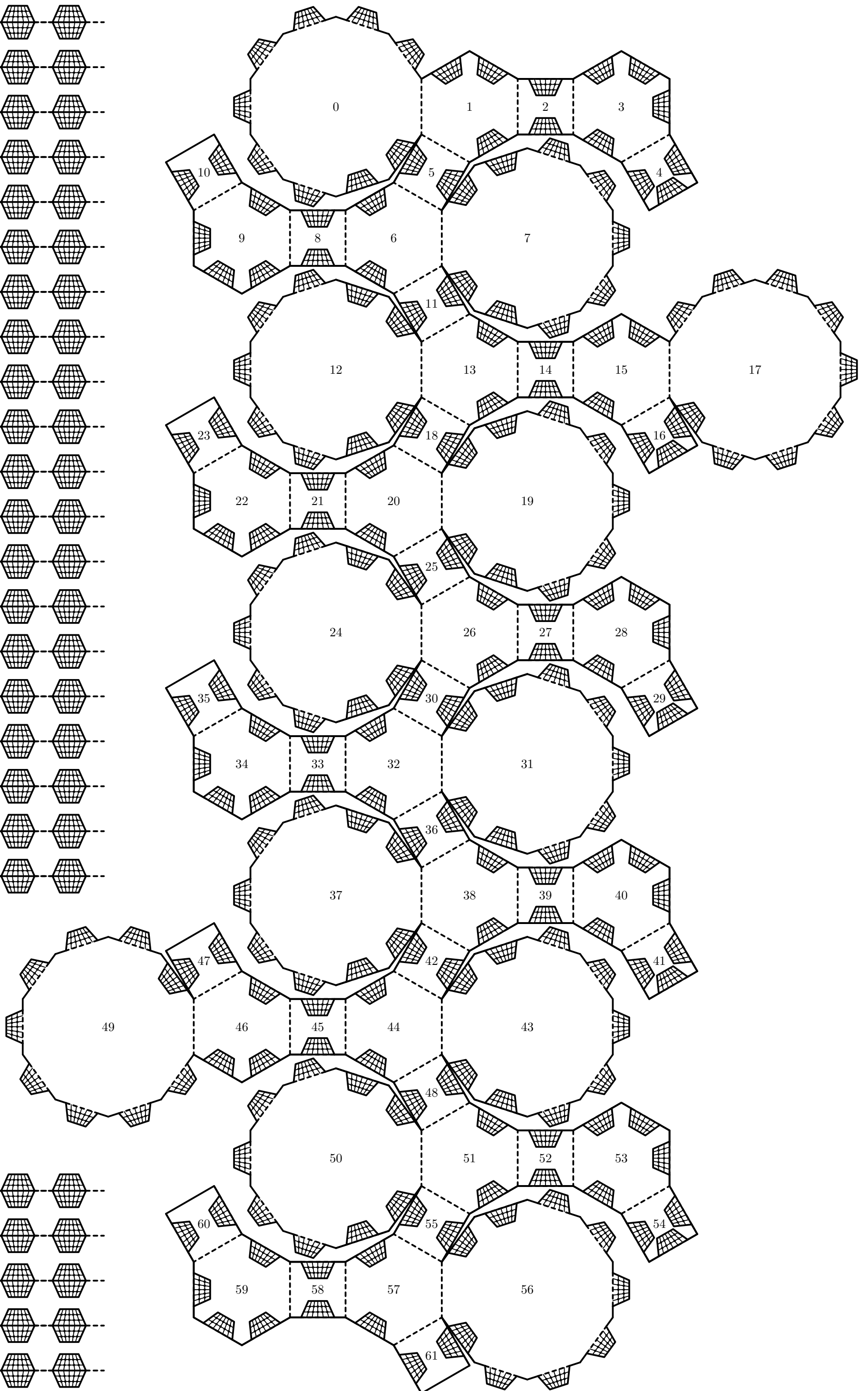
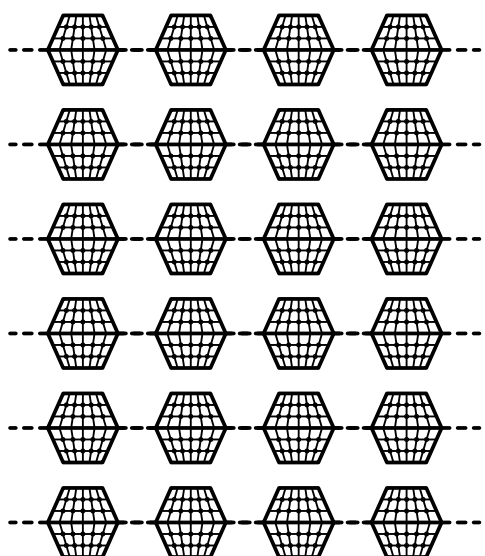
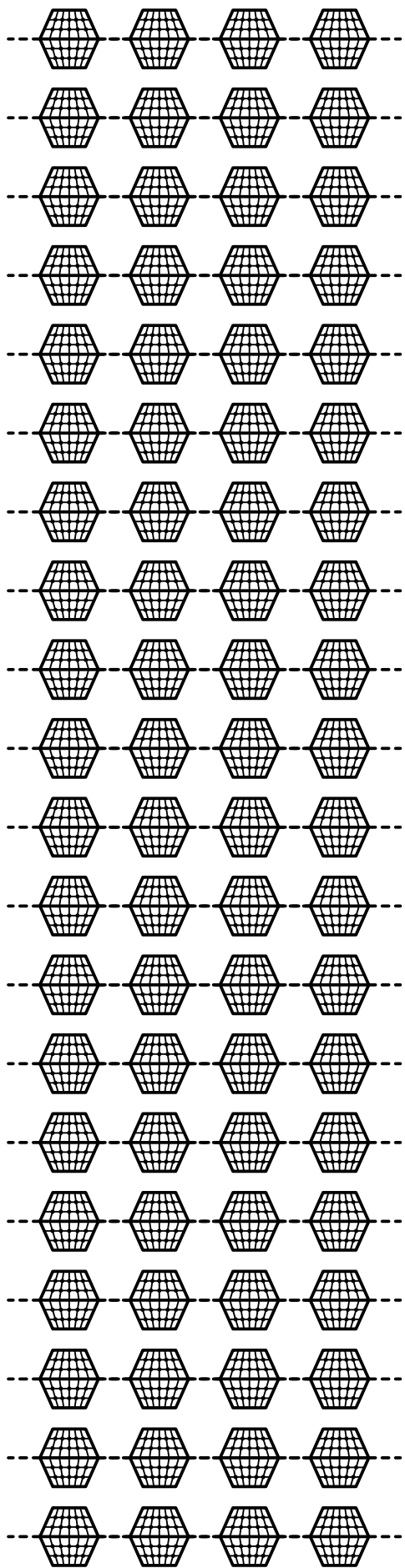
I recommend using hide glue, which must be soaked in water and heated in a glue pot.

I like to glue watercolor paper onto my models, since Bristol board is not a particularly attractive material. This pages and page 3 contain patterns for cutting out polygons to be attached to the sides of the pyramids. A copy of the plan for the nets should not be used for this purpose, because the polygons butt up against each other. To cut out the individual polygons precisely, there must be gaps between them.

## Patterns for Square Watercolor Paper Cut-Outs

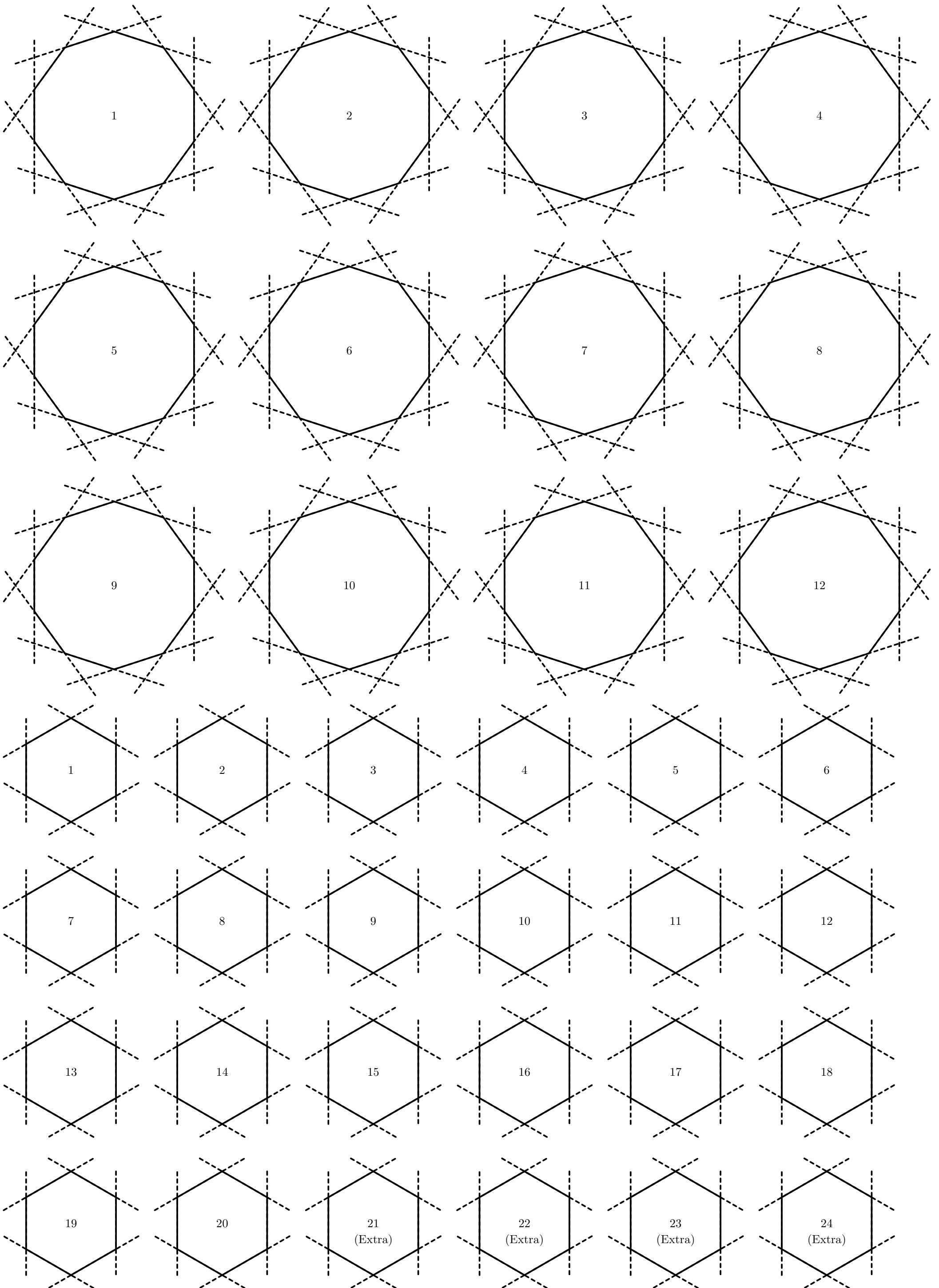
1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26
27	28	29	30	31 (Extra)	32 (Extra)	33 (Extra)	34 (Extra)	35 (Extra)	36 (Extra)	37 (Extra)	38 (Extra)	39 (Extra)

Double Tabs



### Patterns for Watercolor Paper Cut-Outs

(Decagons and Hexagons)



## Sphere Model 1

Laurence D. Finston

Created: October 20, 2009

Last updated: June 4, 2010

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Any corrections will be gratefully received by the author. Contact information can be found on the title page.

These plans represent a "development" of a sphere: The individual figures are "flattened-out" spherical biangles corresponding to 1/8 of a sphere.

To use these plans, tape, tack or otherwise attach them to a sheet of paper which should be robust, but not too thick. I generally prefer tacking to taping, where possible.

Fairly light, smooth watercolor paper might be a good choice. Bristol board or cardboard cannot be used for this model, because the pieces need to be able to bend.

First, prick out the holes for the stitches and then use a cutting knife to cut out the *outer* lines of the plan. **Please note:** The *inner* lines are only for reference and should not be scored! Crosshairs in black mark the places where holes should be pricked. Toward the ends where the curves get very close to the edges, holes should not be pricked. I have added numbers and tick-marks beside the even-numbered crosshairs and also further along the curves beyond where holes should be pricked. The numbers and tick marks should be written on both sides of the pieces when they are cut out; otherwise, it is nearly impossible to align the pieces correctly when assembling the model.

There are two additional crosshairs at tick mark 15 at each end. Here, holes should be pricked and a thread run through them for pulling the ends together *carefully* to finish assembling the model.

**Please Note:** This is not an ideal solution for the ends. A better idea would be some kind of "polar cap". I will try to work on this as soon as possible. (2010.06.04.)

Felt mats are available at hobby supply stores. I find they work well for pricking out the holes.

The numbers on the spherical biangles and the letters "L" and "R" (for "Left" and "Right") are merely for reference. Once the pieces are cut out, and especially during assembly when the pieces are bent, it becomes difficult to tell which side is which.

The knife must be sharp as watercolor paper (or other heavy papers) will dull the blade quickly. I have been using knives with disposable blades. I've been meaning to try sharpening them but haven't done so yet. I therefore can't say whether this will work. It seems a shame to waste so many blades, which is why I have a jar full of them. They must be good for something.

It will be necessary to reattach the plans parts of them are cut out.

Make sure that the plan is attached smoothly or you will introduce inaccuracies. *Do not detach it or let it slip until you are done!* You will never get it back where it's supposed to go. However, with this model, this is only important for an individual piece, since they aren't attached to each other.

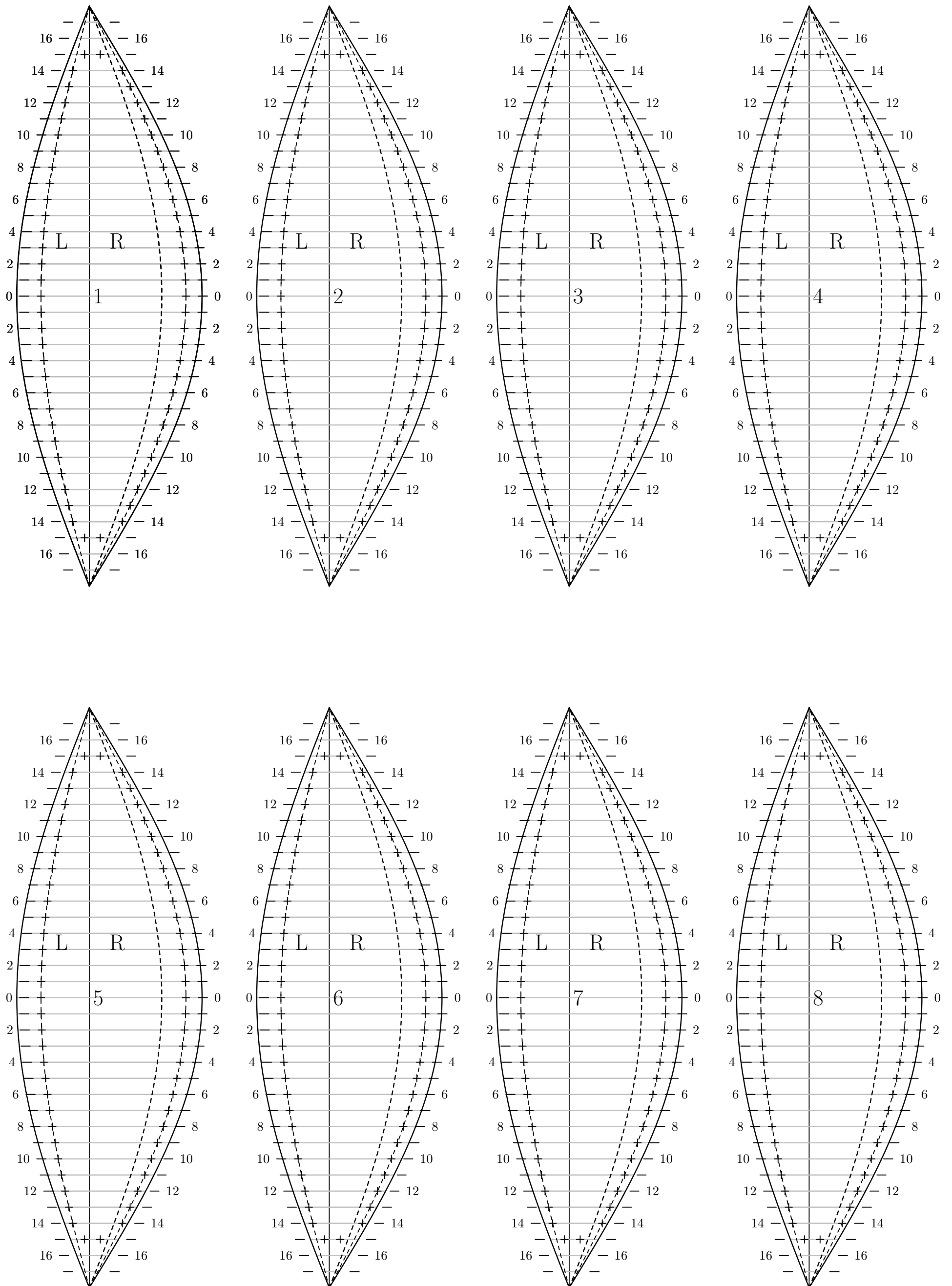
If you use tape, please use the removable kind. Ordinary masking tape will damage the paper when it is removed. Be aware that "removable tape" isn't completely reliable, especially if left too long on the drawing. Sometimes it's possible to reuse pieces of it, which avoids wasting large amounts of it.

Each figure contains 5 curves: From left-to-right: 1. the left edge of the spherical biangle, 2. an inner curve for stitches, 3. the right edge of the spherical biangle, 4., an outer curve for stitches, 5. a curve that's even further out to provide an offset so that holes can be punched for the stitches in curve number four.

Once they are punched and cut out, two pieces A and B should be joined so that the outer curve for stitches on A (4) should be placed over the inner curve for stitches on B (2). Then, curve 4 of B should be placed over curve 2 of a third piece, C, and so forth. As the sphere closes, it will probably be necessary to pre-thread the holes in such a way that the threads can be pulled tight without having to reach inside the (partial) sphere. However, it may be possible to use a curved needle, such as an upholsterer's needle. While the author has partially assembled the model, he hasn't gotten to this point yet (as of 2010.06.02).



# Spherical Biangles



## Sphere Model 2

Version With Separate Tabs

Laurence D. Finston

Created: May 31, 2010

Last updated: June 4, 2010

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Any corrections will be gratefully received by the author. Contact information can be found on the title page.

These plans represent a "development" of a sphere: The individual figures are "flattened-out" spherical biangles corresponding to 1/8 of a sphere.

This version of the model consists of separate pieces which must be joined by using tabs placed under the spherical biangles. They will not be visible when the model is assembled.

To use these plans, tape, tack or otherwise attach them to a sheet of paper which should be robust, but not too thick. I generally prefer tacking to taping, where possible.

Fairly light, smooth watercolor paper might be a good choice. Bristol board or cardboard cannot be used for this model, because the pieces need to be able to bend. In addition, if the paper is too thick, it may be difficult to attach the tabs. For better accuracy, it would be necessary to account for the thickness of the paper when calculating the shape of the tabs.

First, prick out the holes for the stitches and then use a cutting knife to cut out the *outer* lines of the plan. **Please note:** The *inner* lines are only for reference and should not be scored! Crosshairs in black mark the places where holes should be pricked, on both the pieces and the tabs. Toward the ends where the curves get very close to the edges, holes should not be pricked. I have added numbers and tick-marks beside the even-numbered crosshairs and also further along the curves beyond where holes should be pricked. The numbers and tick marks should be written on both sides of the pieces and tabs when they are cut out; otherwise, it is nearly impossible to align them correctly when assembling the model.

There are two additional crosshairs at tick mark 15 at the ends of the pieces. Here, holes should be pricked and a thread run through them for pulling the ends together *carefully* to finish assembling the model.

**Please Note:** This is not an ideal solution for the ends. A better idea would be some kind of "polar cap". I will try to work on this as soon as possible. (2010.06.04.)

Felt mats are available at hobby supply stores. I find they work well for pricking out the holes.

The knife must be sharp as watercolor paper (or other heavy papers) will dull the blade quickly. I have been using knives with disposable blades. I've been meaning to try sharpening them but haven't done so yet. I therefore can't say whether this will work. It seems a shame to waste so many blades, which is why I have a jar full of them. They must be good for something.

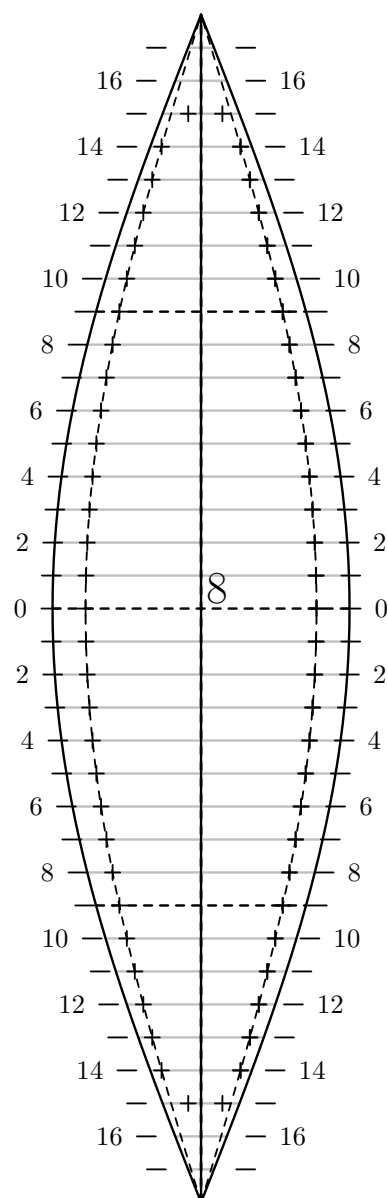
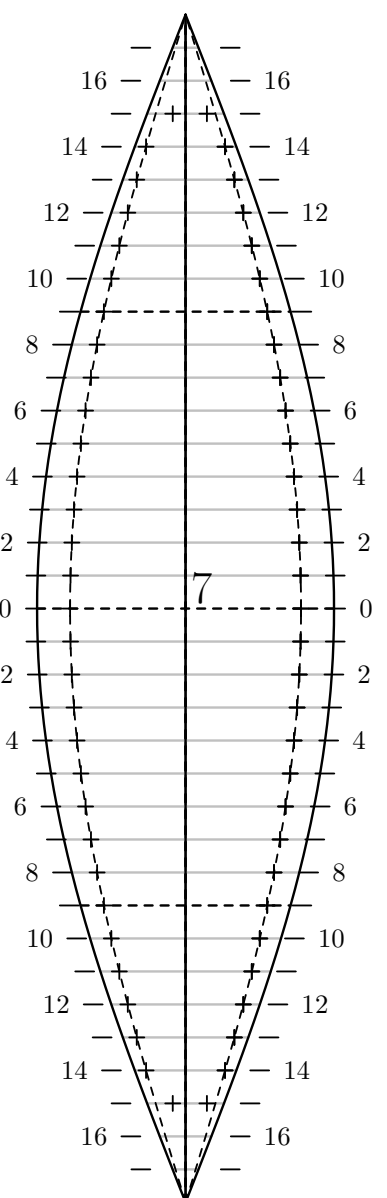
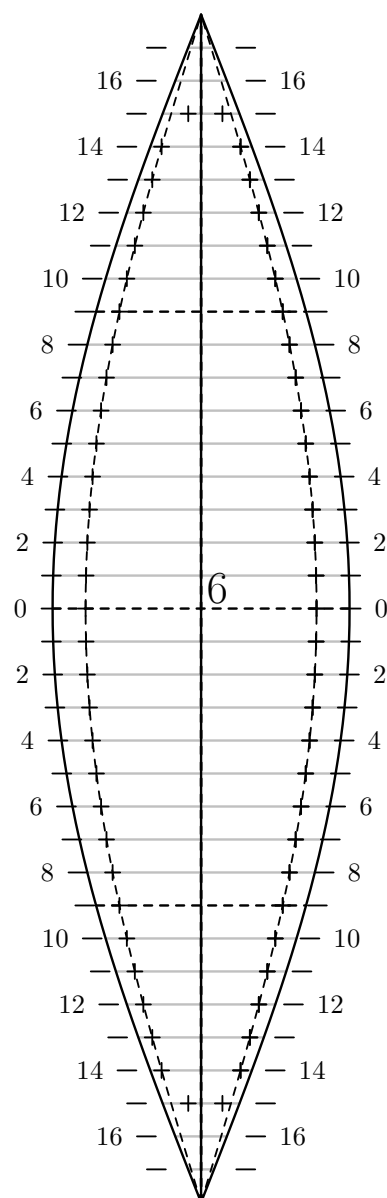
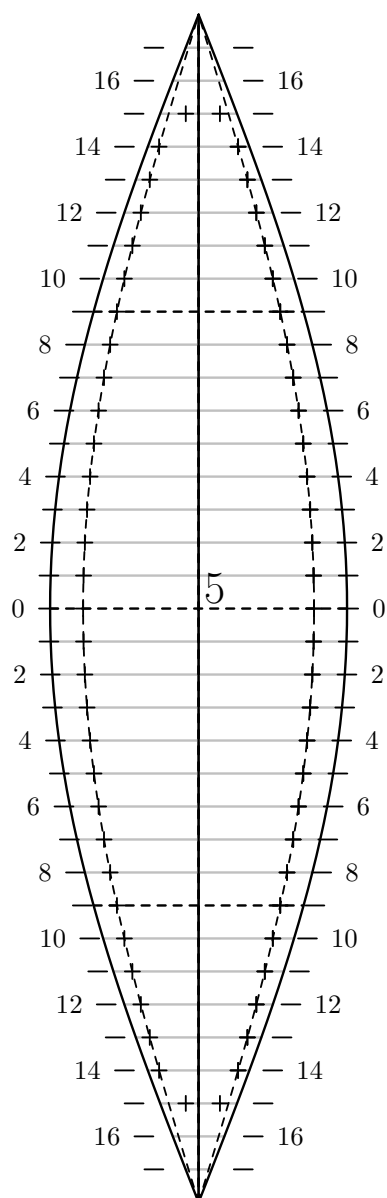
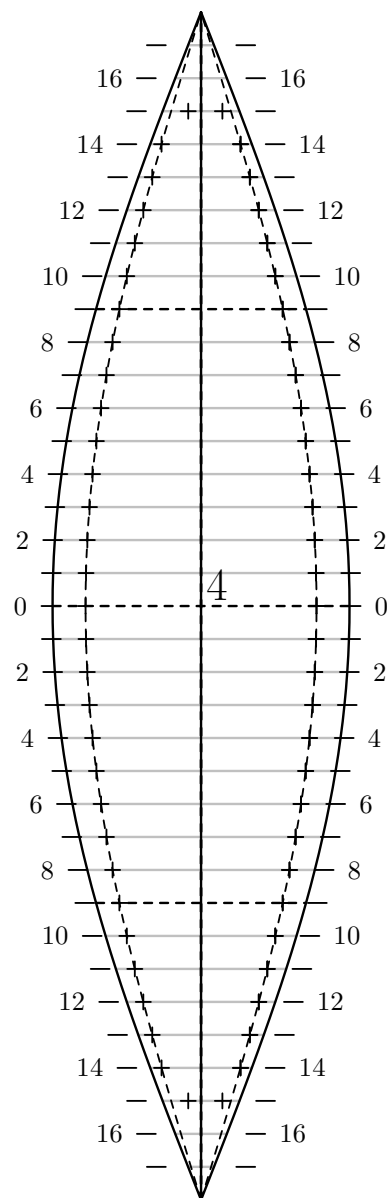
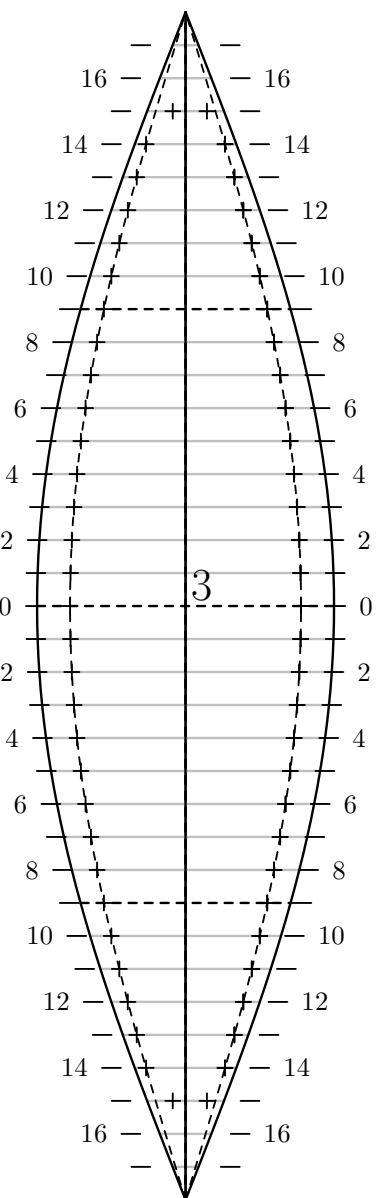
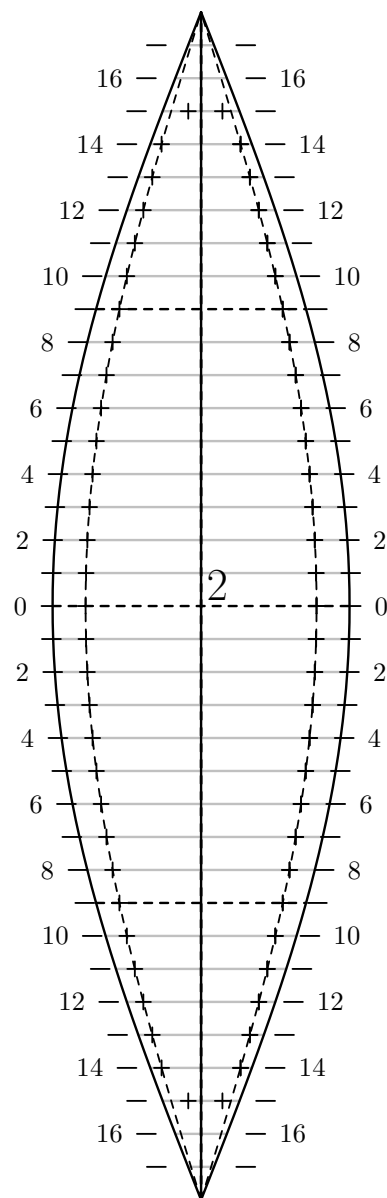
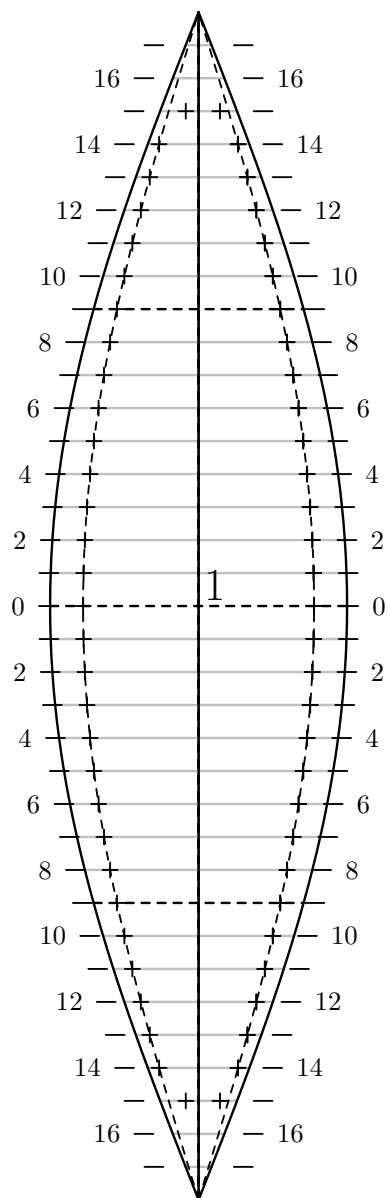
It will be necessary to reattach the plans parts of them are cut out.

Make sure that the plan is attached smoothly or you will introduce inaccuracies. *Do not detach it or let it slip until you are done!* You will never get it back where it's supposed to go. However, with this model, this is only important for an individual piece, since they aren't attached to each other.

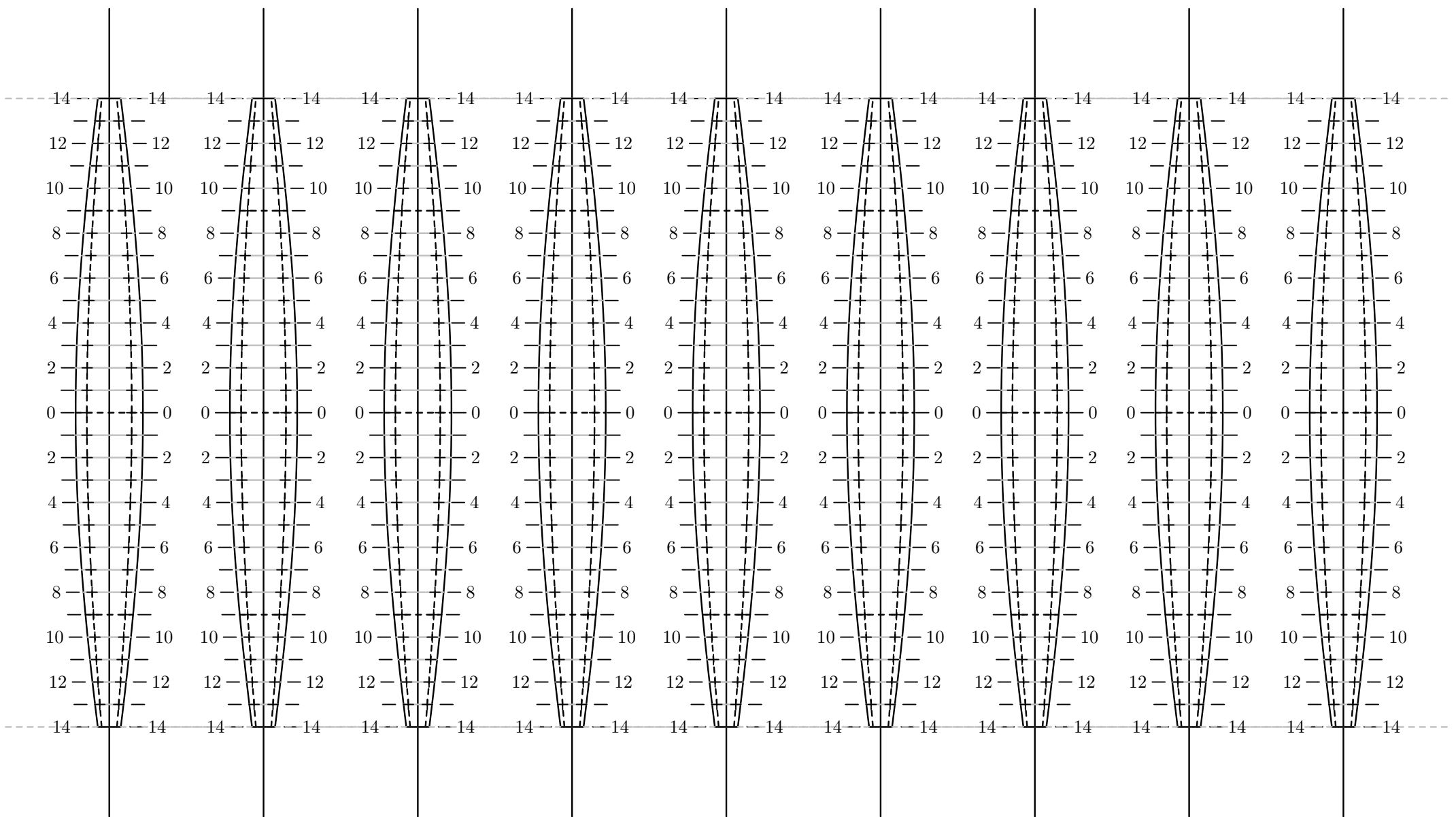
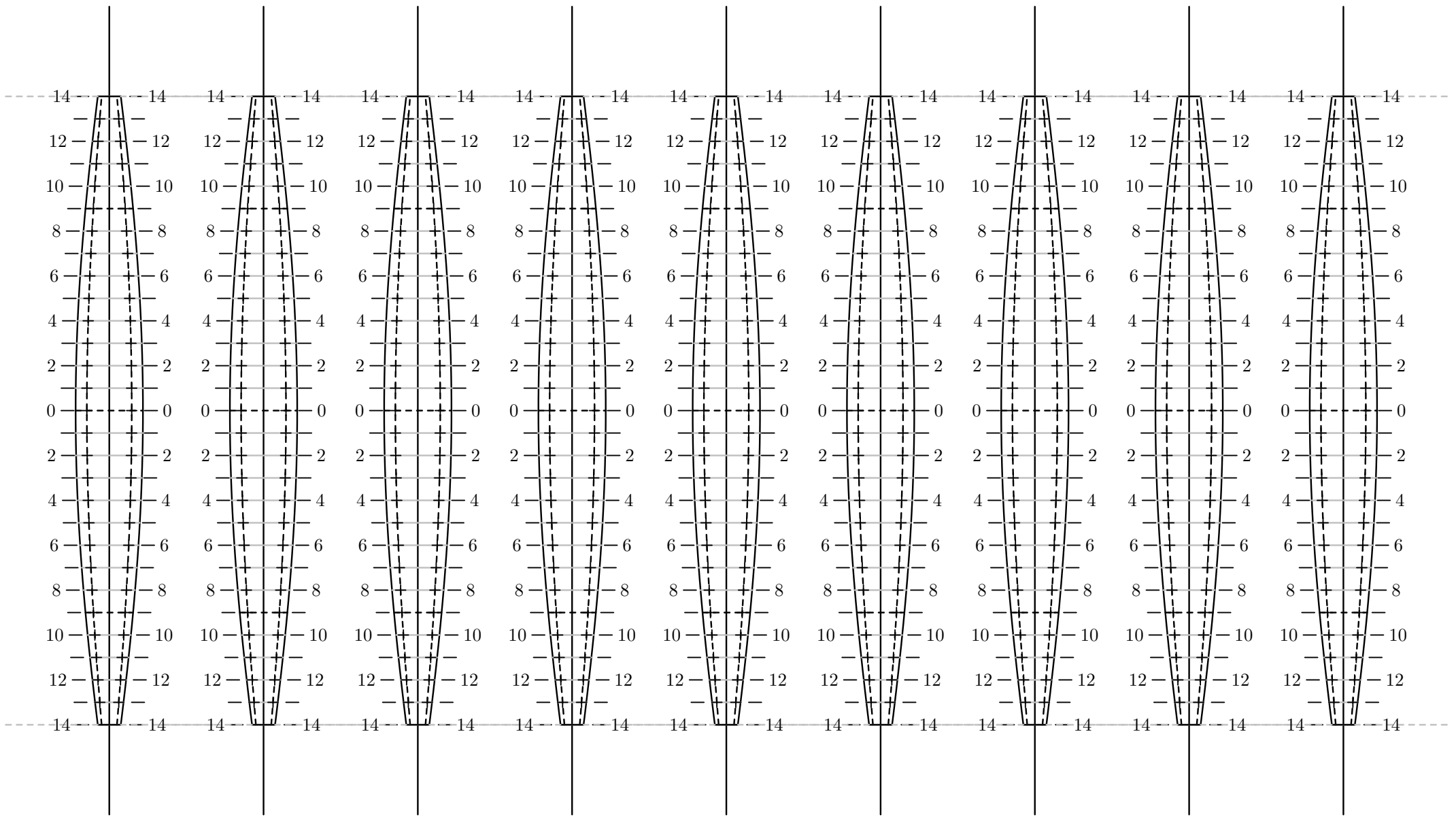
If you use tape, please use the removable kind. Ordinary masking tape will damage the paper when it is removed. Be aware that "removable tape" isn't completely reliable, especially if left too long on the drawing. Sometimes it's possible to reuse pieces of it, which avoids wasting large amounts of it.

Each figure has three curves on the left and right sides: 1. the edge of the spherical biangle, 2. an inner curve for stitches, 3. the trace of the edge of the tab used to join each piece with its neighbour.

# Spherical Biangles



# Tabs



### Sphere Model 3

Laurence D. Finston

Created: July 16, 2010

Last updated: August 13, 2010

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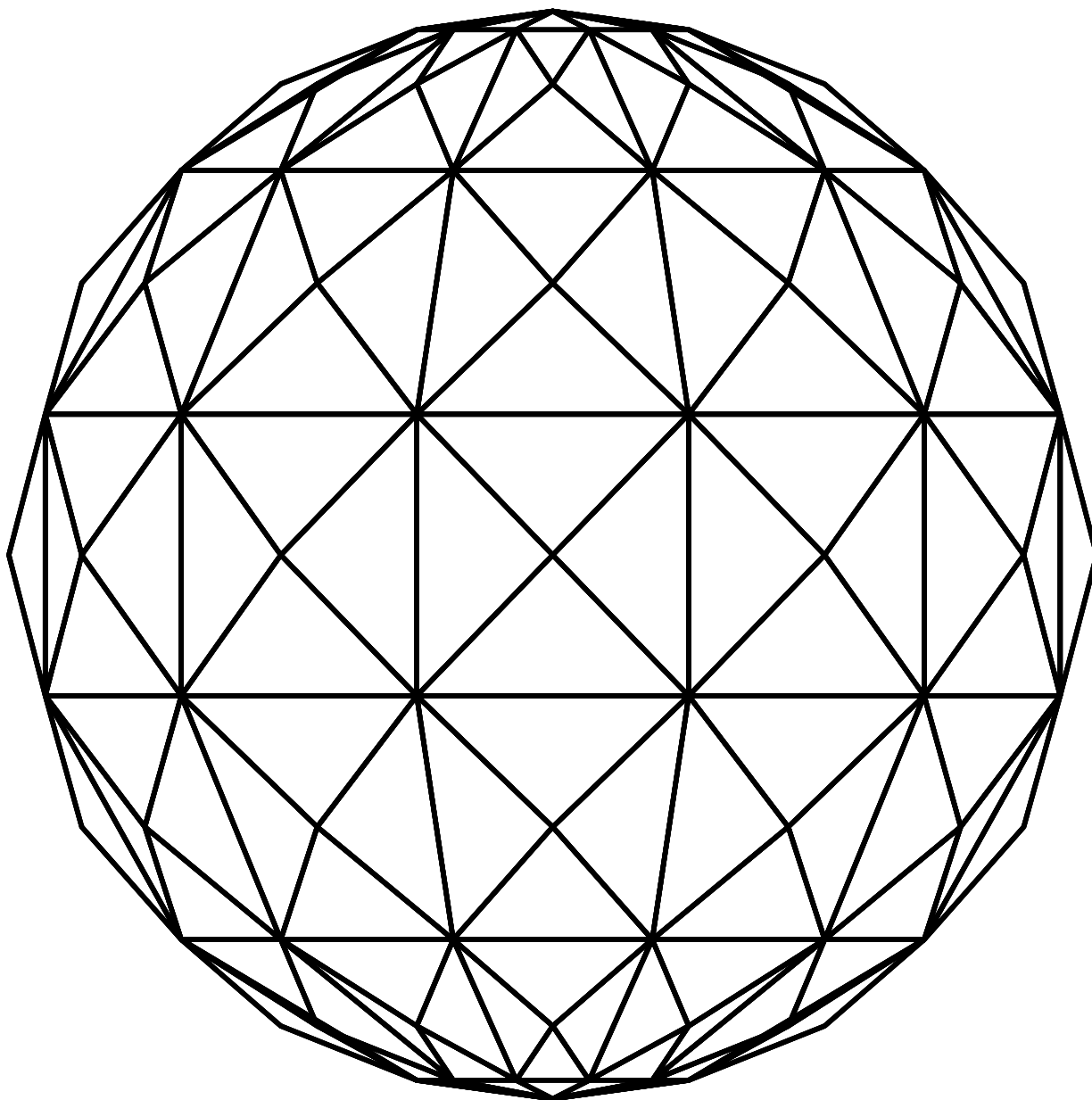
The mailing list [info-3dldf@gnu.org](mailto:info-3dldf@gnu.org) is for sending announcements to users. To subscribe to this mailing list, send an email with "subscribe (email-address)" as the subject.

The webpages for GNU 3DLDF are here: <http://www.gnu.org/software/3dldf/LDF.html>

The author can be contacted at:

Laurence D. Finston  
c/o Free Software Foundation, Inc.  
51 Franklin St, Fifth Floor  
Boston, MA 02110-1301  
USA

[Laurence.Finston@gmx.de](mailto:Laurence.Finston@gmx.de)



## Instructions

**PLEASE NOTE!** The author has tried to ensure that the following plans are correct, but as of August 6, 2010, he has not tested them yet himself. As mentioned above, this material is distributed **without a warranty**. I recommend that users check it themselves before investing a lot of time and effort into cutting out the paper or cardboard model.

Any corrections or other feedback will be gratefully received by the author. Contact information can be found above.

These plans represent a sphere divided into unlike triangles. The source code can be found in the file `sphrmd03.ldf` which is available from the GNU 3DLDF Sphere and Dome Models webpage:

[http://www.gnu.org/software/3dldf/sphrdmmd.html#Sphere\\_Models](http://www.gnu.org/software/3dldf/sphrdmmd.html#Sphere_Models)

The GNU 3DLDF program that generates the plans and other images in this document, i.e., the code in `sphrmd03.ldf`, uses parameters for various values; in particular, the radius of the sphere and the arc angle that separates the points on the sphere that are used to find the points on the triangles. By changing the values of the parameters, variations of these plans can be generated. However, one must be careful, since some values may cause unforeseen problems or unsatisfactory results, or require changes to other parts of the program.

The center of the sphere is located at the origin. The radius of the sphere used here is 5.375cm. It was chosen in order to have (approx.) the largest possible sphere for which the plans would fit onto a single sheet of DIN A3 paper.

The sphere is divided into 5 “bands” plus two pyramids with dodecagonal bases for the poles. The bands, in turn, each consist of 12 sets of 4 triangles. When the model is folded together, each set of 4 triangles becomes a pyramid with a trapezoidal base, whereby the the base of the pyramids belonging to the middle band are rectangular.

The corner points of the trapezoidal or rectangular bases represent line segments that join points on 30° arcs of circles that lie on the surface of the sphere and are parallel to one of the major planes (and perpendicular to the others). Other plans may be created by changing the angle used for the arcs, but this would certainly require modifying other parts of the program. However, it shouldn't be too difficult.

To use these plans, tape, tack or otherwise attach them to a sheet of paper or cardboard. I generally prefer tacking to taping, where possible. Cardboard could be used for this model, since all of the pieces are flat, but heavy paper would probably also result in an adequately stable model.

This model uses “double tabs” for attaching pieces to each other. The triangles on the plans on page 4 have traces of the tabs drawn on them. The tabs themselves are on page 5. The tabs can be used for sewing the model together, either in combination with gluing or alone. The model can be assembled by gluing alone, in which case no holes need to be pricked on the tabs or the triangles. Nor is it necessary in this case for the tabs to match up with the traces when assembling the model.

Sewing, however, will generally lead to better results, especially with regard to the alignment of the pieces. In this case, the crosshairs in black mark the places where holes should be pricked, on both the pieces and the tabs. It may also be advisable to transfer the lines of the traces to the cardboard or paper using graphite paper or in some other way.

Felt mats are available at hobby supply stores. I find they work well for pricking out the holes.

The solid (outer) lines should be cut out, while the dashed (inner) lines should be scored only. I have tried to be careful about drawing dashed and solid lines correctly, but due to the complexity of this model, I can't be sure that I haven't made any mistakes until I've tried it myself. (Even then, mistakes like this can slip past one easily.) Please exercise care when cutting out the model and don't cut through the paper or cardboard if you have any doubts about a solid line being correct! However, in an emergency, an additional tab should fix the problem, if a line is cut through by mistake, and the difference in the finished model will be negligible.

The knife must be sharp as heavy paper or cardboard will dull the blade quickly. I have been using knives with disposable blades. I've been meaning to try sharpening them but haven't done so yet. I therefore can't say whether this will work. It seems a shame to waste so many blades, which is why I have a jar full of them. They must be good for something. I don't think scissors would work well for this model, and I don't recommend scoring with scissors, because this will dull its blade unnecessarily. However, this isn't a hard-and-fast rule, if someone prefers scissors.

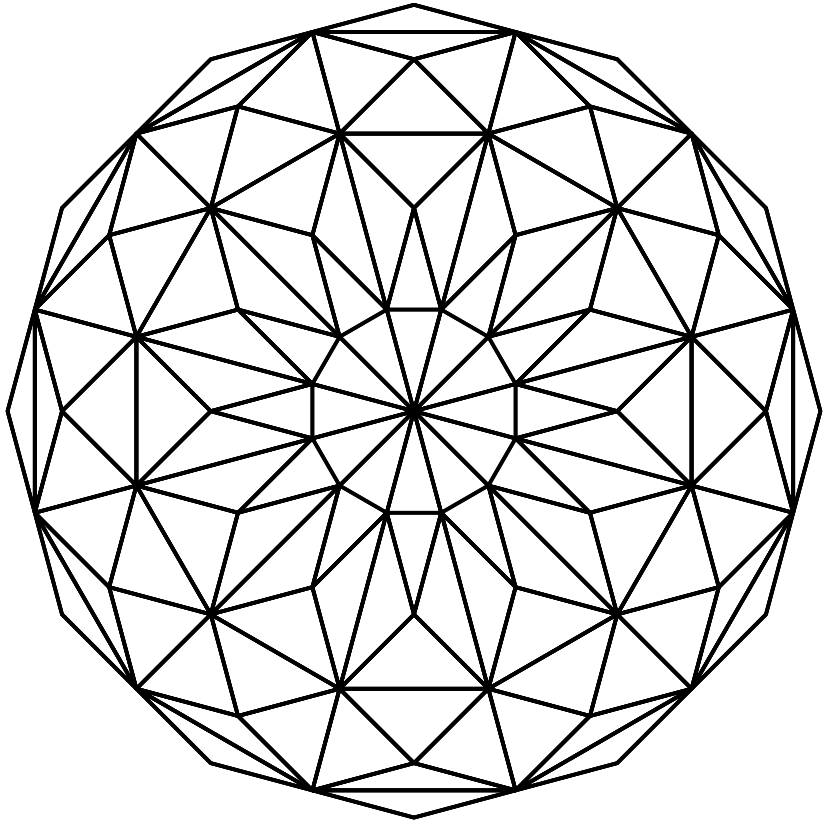
It will be necessary to reattach the plans parts of them are cut out.

Make sure that the plan is attached smoothly or you will introduce inaccuracies. *Do not detach it or let it slip until you are done!* You will never get it back where it's supposed to go.

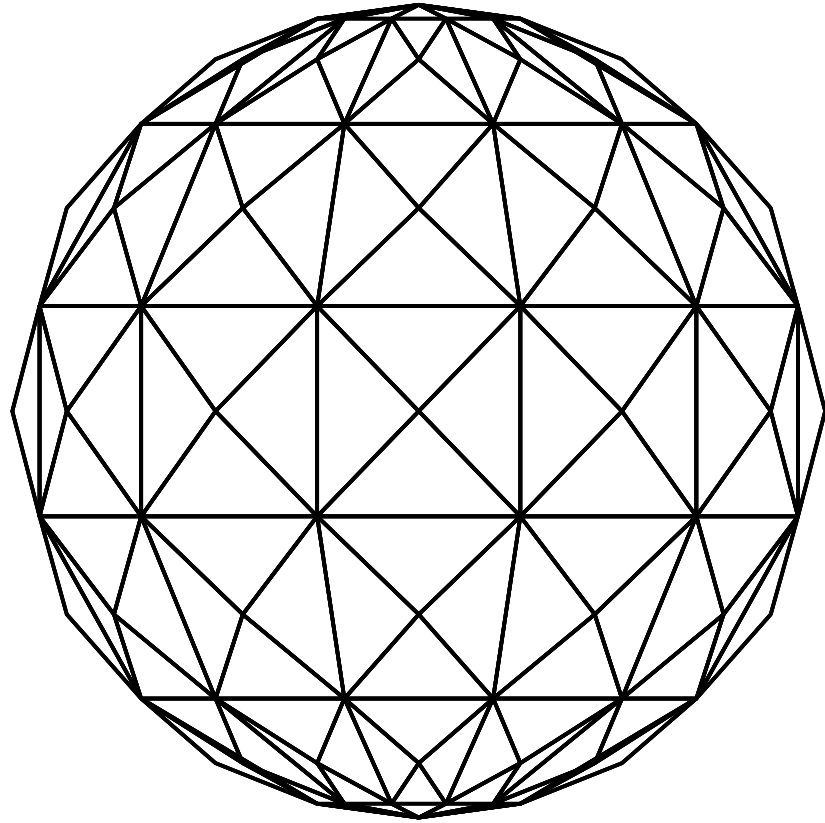
If you use tape, please use the removable kind. Ordinary masking tape will damage the paper when it is removed. Be aware that “removable tape” isn't completely reliable, especially if left too long on the drawing. Sometimes it's possible to reuse pieces of it, which avoids wasting large amounts of it.

Pages 6–7 contain patterns for the various triangles that appear in the plans with dashed lines to make it easier to cut them out. These patterns can used to cut triangles out of better quality paper, such as watercolor paper, which can then be attached to the assembled model. This may improve the appearance of the model, especially if it is to be painted. One might also cut the triangles out of good quality colored paper.

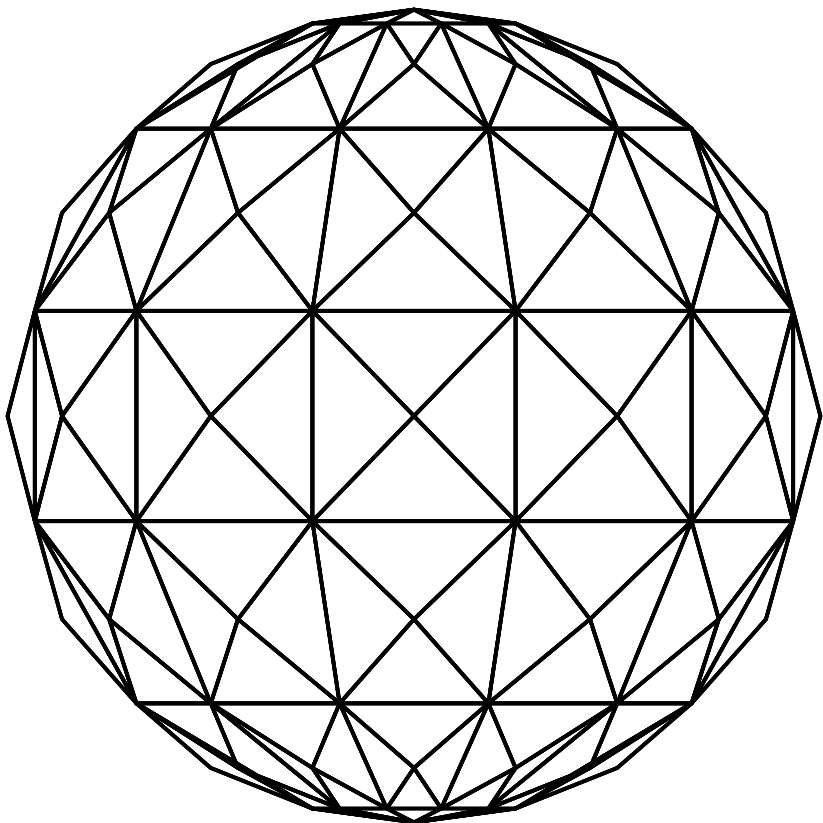
Radius of sphere: 5.375cm  
Center at origin



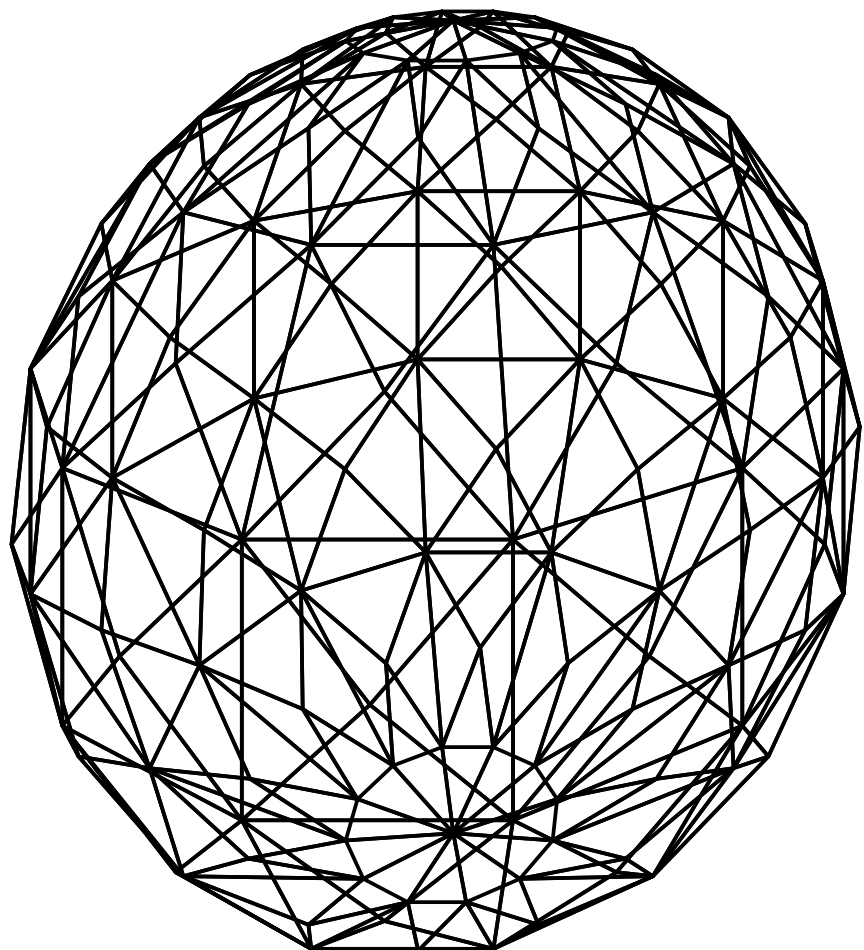
Parallel Projection onto the x-z plane



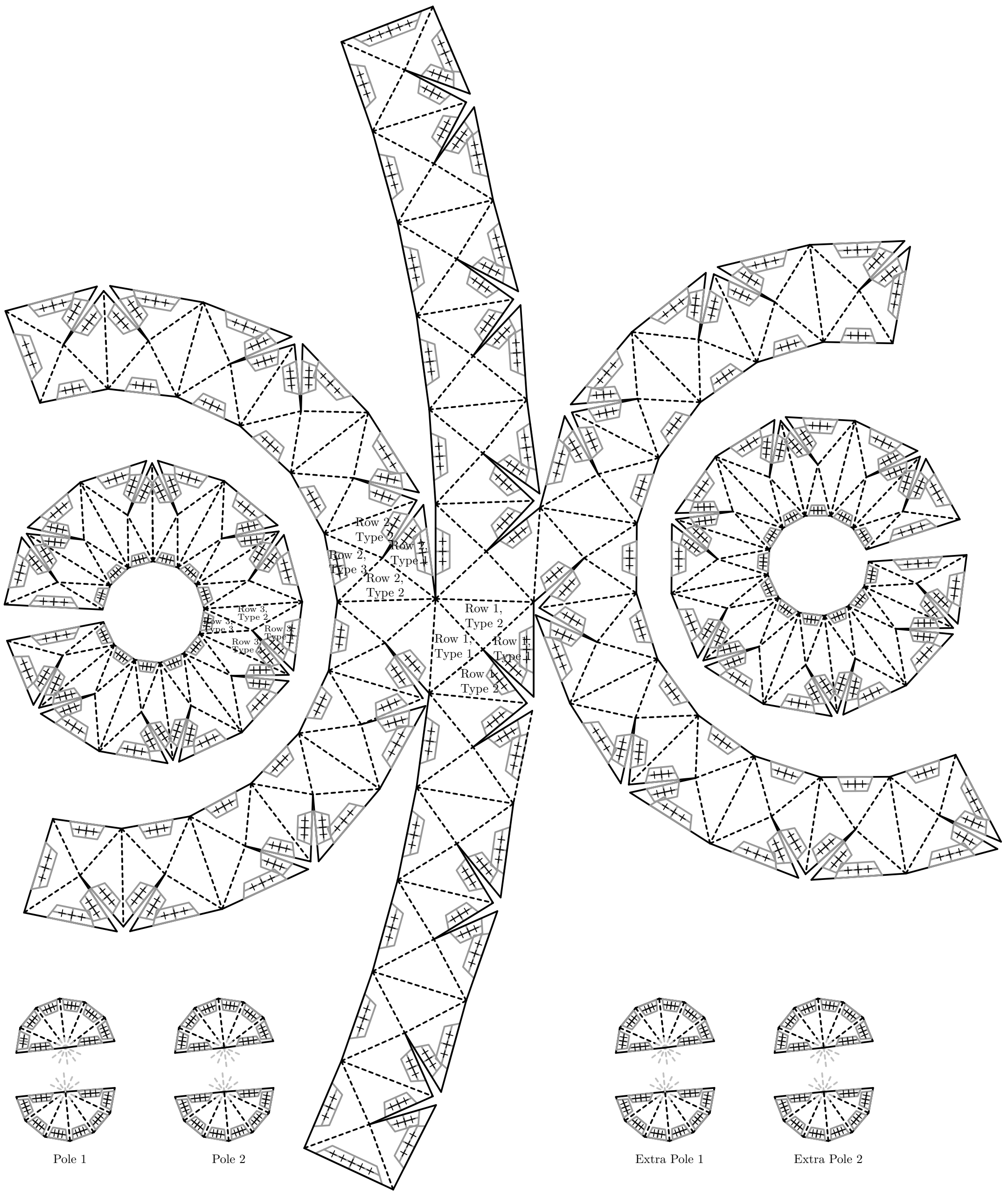
Parallel Projection onto the x-y plane



Parallel Projection onto the z-y plane



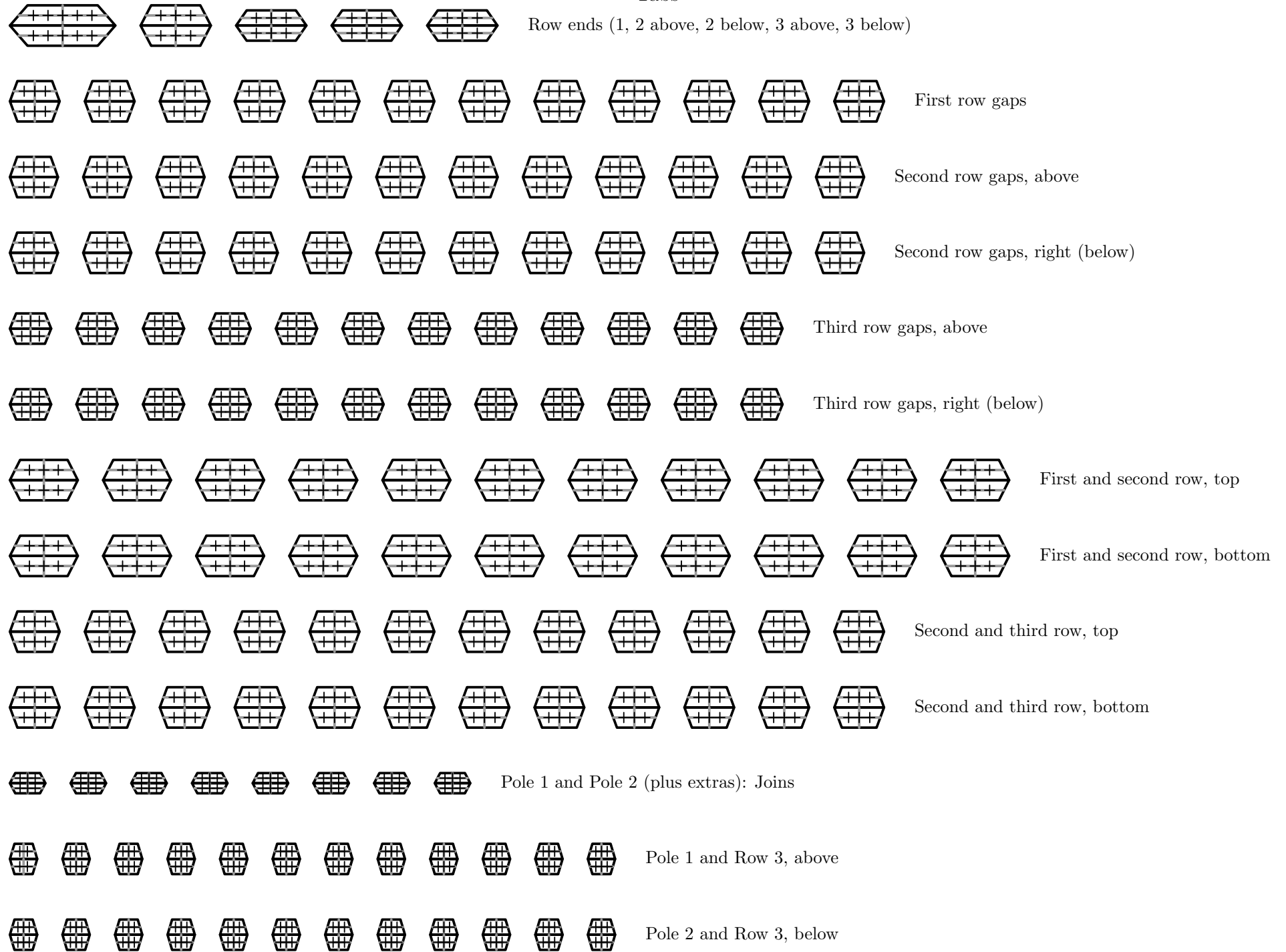
Perspective Projection  
Position of focus: (3cm, 10cm, -20cm)  
Direction of view: (3cm, 10cm, 10cm)  
Distance from plane of projection: 20cm



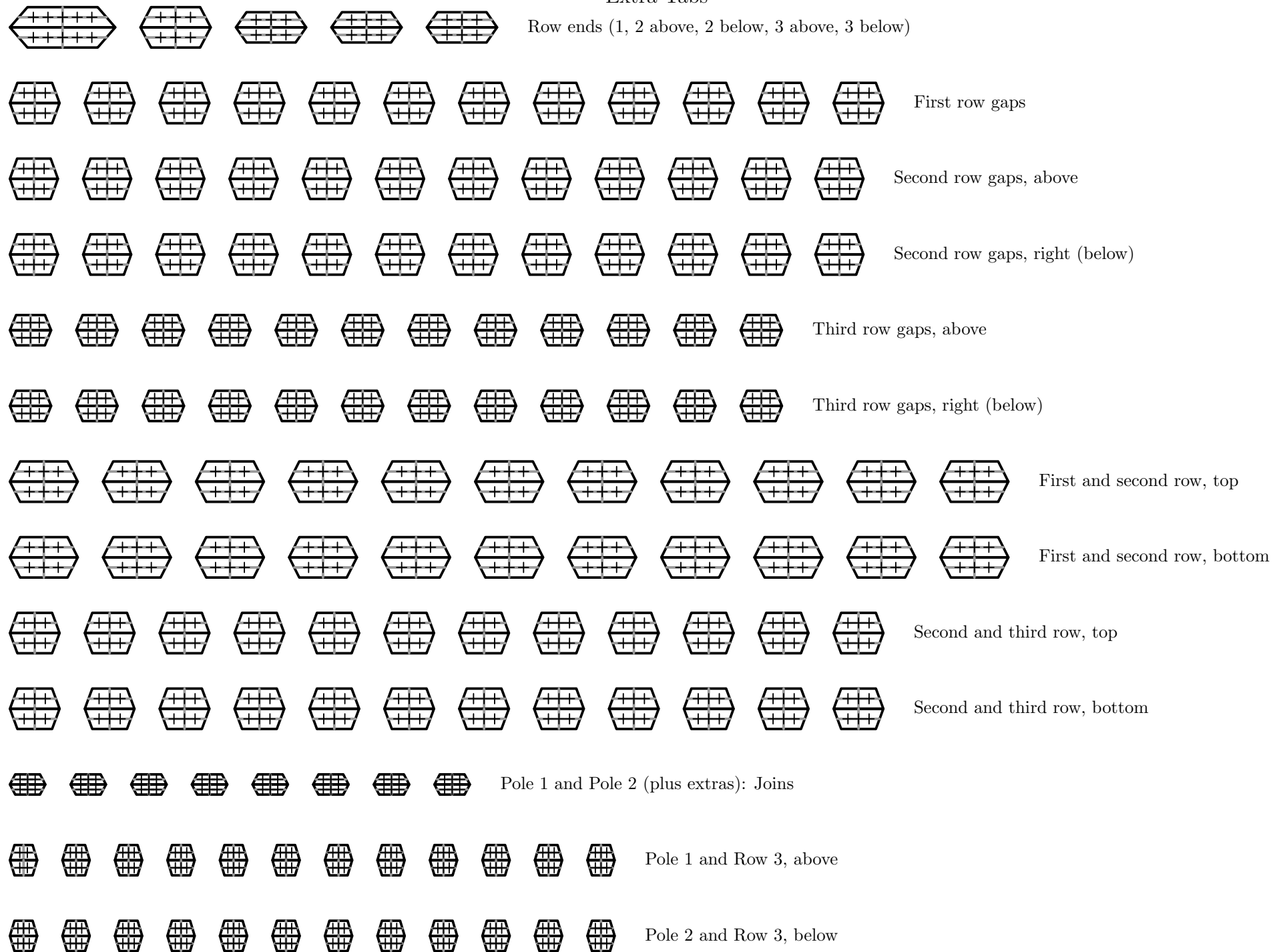
Model Plans



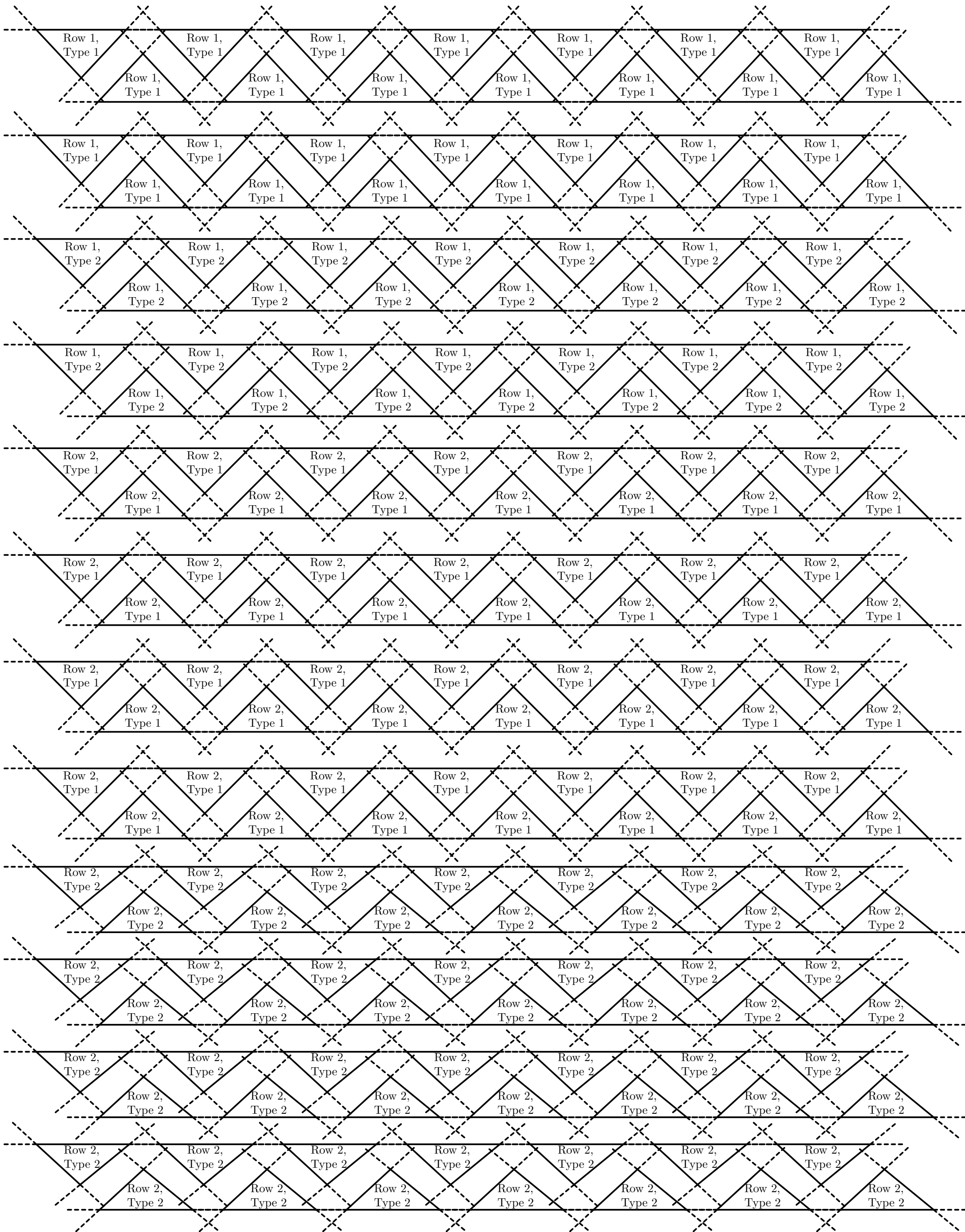
Tabs



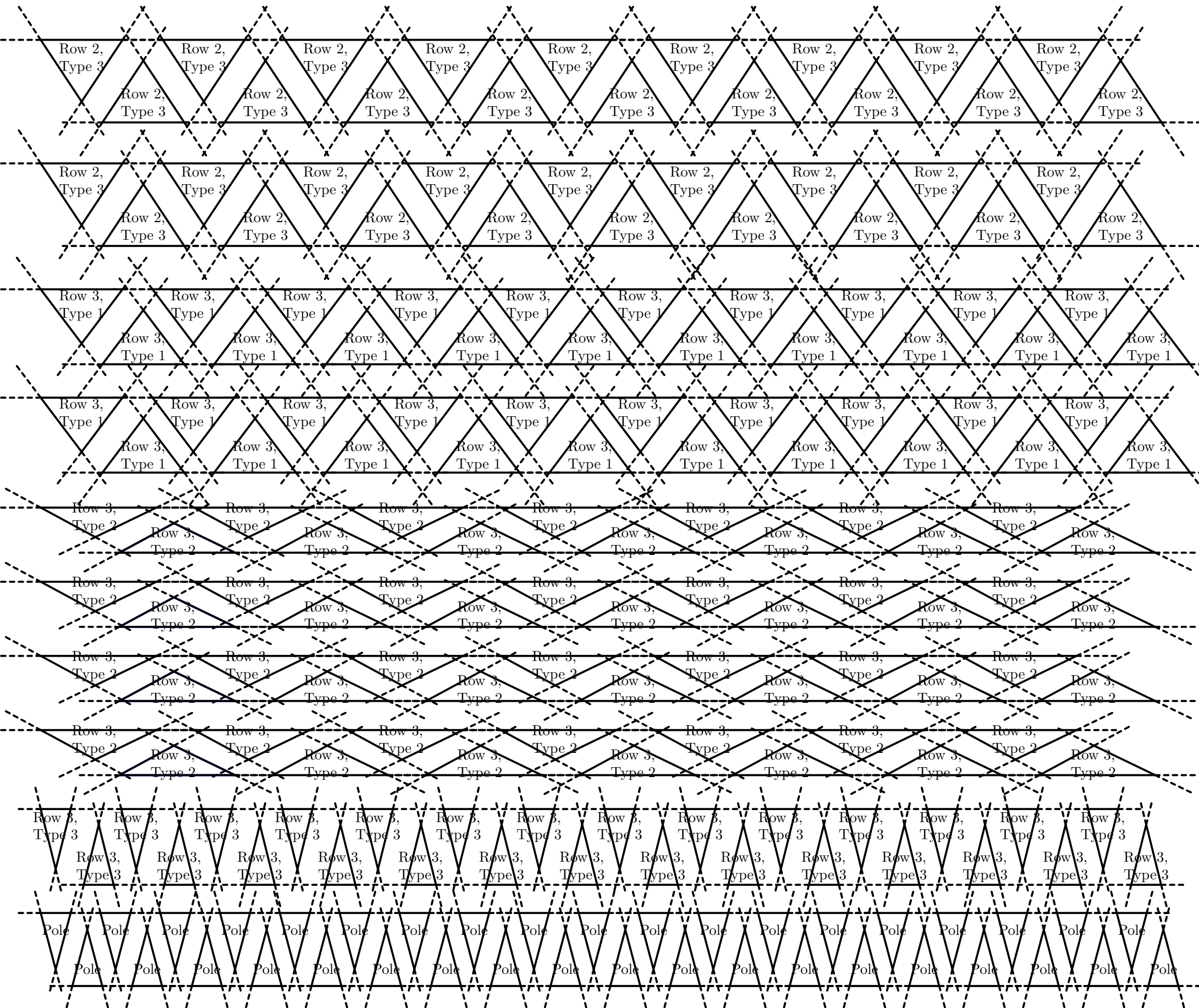
Extra Tabs



Triangles for Cutting-Out 1



Triangles for Cutting-Out 2



Great Stellated Dodecahedron Net 1

Laurence D. Finston

Created: January 5, 2009

Last updated: January 8, 2009

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The author can be contacted at:

Laurence D. Finston  
c/o Free Software Foundation, Inc.  
51 Franklin St, Fifth Floor  
Boston, MA 02110-1301  
USA

[Laurence.Finston@gmx.de](mailto:Laurence.Finston@gmx.de)

## Instructions

**PLEASE NOTE!** The author has tried to ensure that the following plans are correct, but as of January 8, 2009, he has not tested them yet himself. As mentioned above, this material is distributed **without a warranty**. I recommend that users check it themselves before investing a lot of time and effort into cutting out the cardboard model.

Any corrections will be gratefully received by the author. Contact information can be found on the title page.

To use these plans, tape or otherwise attach them to a sheet of Bristol board or heavy paper. Then use a cutting knife to cut the *outer* and *score* the inner lines of the plan. **Please note**, however, that the traces of the tabs and the dotted lines with larger dots within the triangles should not be scored! The knife must be sharp as Bristol board will dull the blade quickly.

The large dots show where holes should be poked for stitches. The latter are meant to be used for aligning each pair of sections of the model where they attach to each other. It is intended that the stitches only be used for alignment and that the model be glued together. However, the stitches may suffice. I haven't tested this, though.

I have been using knives with disposable blades. I've been meaning to try sharpening them but haven't done so yet. I therefore can't say whether this will work. It seems a shame to waste so many blades, which is why I have a jar full of them. They must be good for something.

It will be necessary to retape as bits of the plan are cut out.

Make sure that the plan is taped down smoothly or you will introduce inaccuracies. *Do not untape it or let it slip until you are done!* You will never get it back where it's supposed to go. However, it is possible to start again, make another portion of the plan and attach the pieces. There's no real need to make the net in one piece.

Use removable tape. Ordinary masking tape will damage the paper layer of the Bristol board when it is removed. Be aware that "removable tape" isn't completely reliable, especially if left too long on the drawing. Sometimes it's possible to reuse pieces of it, which avoids wasting large amounts of it.

The sides of faces without tabs have a "trace" of a tab on them, indicating where the tab will lie under it. The dots on the lines through the middle of the tabs and their traces (lengthwise) indicate positions where holes can be made for sewing the model together. This will only be necessary for the last faces, where there's not enough room to fit one's fingers inside the model.

Holes can be made using a needle, if the cardboard isn't too thick. A small tack or brad can be driven through thicker cardboard.

In addition, the equilateral triangles for the faces of the icosahedron and the bases of the pyramids (stellations) have dots for holes. These are to be used for sewing the pyramids to the icosahedron. The holes on the icosahedron will have to be threaded before the latter is assembled and the pyramid attached before it is closed. It may be necessary to thread some of the tabs before starting to close the icosahedron, but it would probably be a good idea, anyway. I shall have to test this myself.

After the glue has hardened, stitches can be picked out and the ends snipped off. If paper is to be glued onto the faces (e.g., watercolor paper), it may not be necessary to remove every last trace of thread.

I recommend using hide glue, which must be soaked in water and heated in a glue pot.

I like to glue watercolor paper onto my models, since Bristol board is not a particularly attractive material. Page 4 contains patterns for cutting out triangles to be attached to the sides of the pyramids. A copy of the plan for the nets should not be used for this purpose, because the triangles butt up against each other. To cut out the individual triangles precisely, there must be gaps between them.

