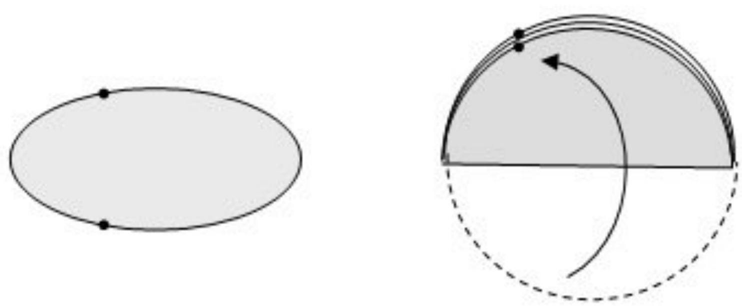
How to Fold Circles I

Anyone that can fold a paper plate in half can do this, four and five years old on up. Paper plates, masking tape and bobby pins are all that are needed. There is no cutting or measuring, only proportional folding the circle. This is a process about touching points. If the points are accurately touching the creases will be exactly where they need to be. Use a hard straight edge to get a good folded crease, a ruler or creasing stick will do. This flattens the paper plate at the same time creasing the folds. Any kind of paper circle will do.

Fold Circle In Half

Imagine two points anywhere on the circumference of a circle; touch them exactly together. This folds the circle in half forming a diameter and two more points on the circumference. The diameter is creased, a perpendicular movement halfway between bringing the two imagined points together. This forms a tetrahedron pattern (4 points in space define a tetrahedron pattern with 6 lines of relationship defining 4 triangle planes.) Two points you see in your mind and the other two you visually see; all 4 are real. This right angle fold is one whole in two parts, a ratio 1:2.



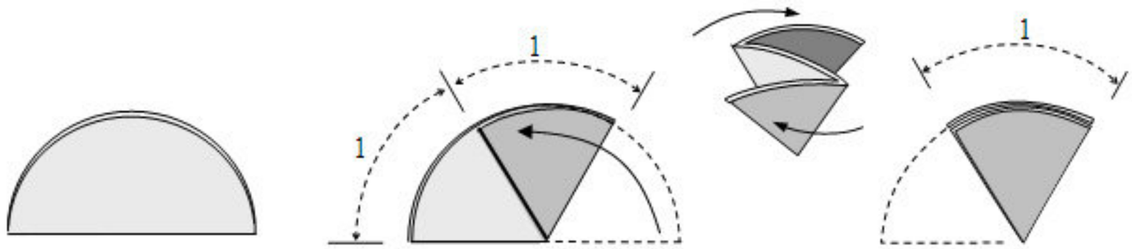
Fold circle in half by touching any two points on the circumference together and crease. Make sure points are touching before creasing.

This movement reflects spherical origin revealing structural pattern. There is far too much information generated in this one fold to go into it here. Everything that happens in this first fold is principle to all subsequent folding of the circle and demonstrates fundamental geometry relationships and math functions.

Fold Three Diameters

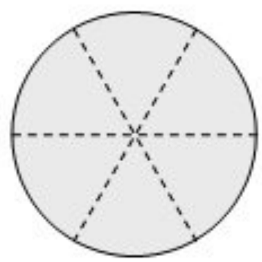
Along the circumference of the half folded circle fold one part on top of two parts unfolded parts. When the circumference is even it will locate the center. The two areas and the center angles will look even. Half of the unfolded part is folded to the back; one fold is on top, one in the middle, and one on the bottom, like a "Z" dividing the half-folded circle into thirds. This allows you to look at all sides to make adjustments to get both end points even, lining up the edges and circumference. Only when points, edges, and circumference look even, do you crease the folds.

Fold one corner point half way over on curved edge making 2 equal parts, in the ratio of 1 over 2. Don't measure! Use your eyes; they are made to see proportionally. Don't crease the folds yet.

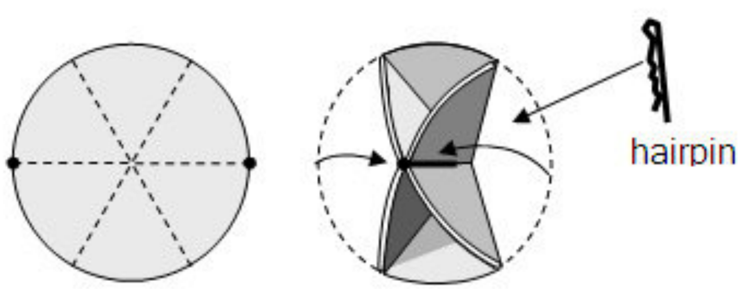


One folded forward, one folded to the back. Get all curved and straight edges even and then crease.

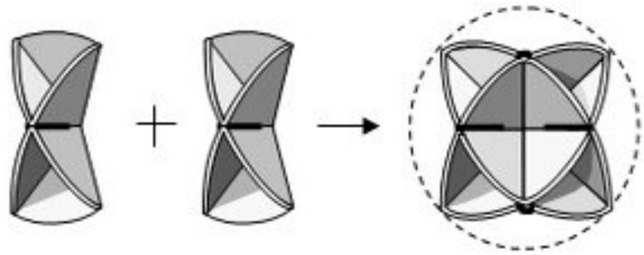
Open the circle to 3 diameters in a hexagon pattern of 7 points (6 end points on the circumference and one center point of intersection). There are 6 equally divided intervals



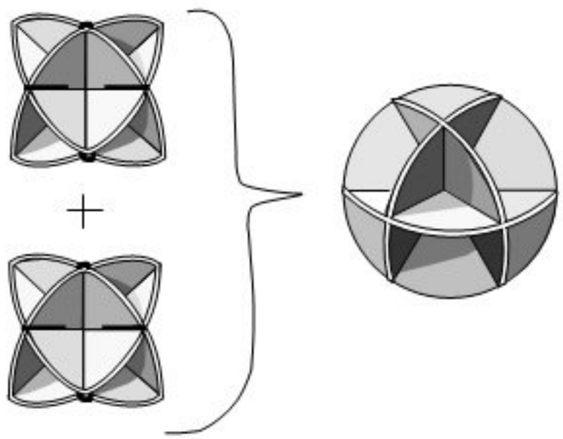
Fold A Vector Equilibrium Sphere



Bring two ends of one diameter together holding edges together with a hairpin. This forms a pattern of 4 tetrahedra; 2 formed open tetrahedra (3 solid planes, one open plane) and 2 tetrahedral intervals (2 solid planes, 2 open planes), 6 points in space.



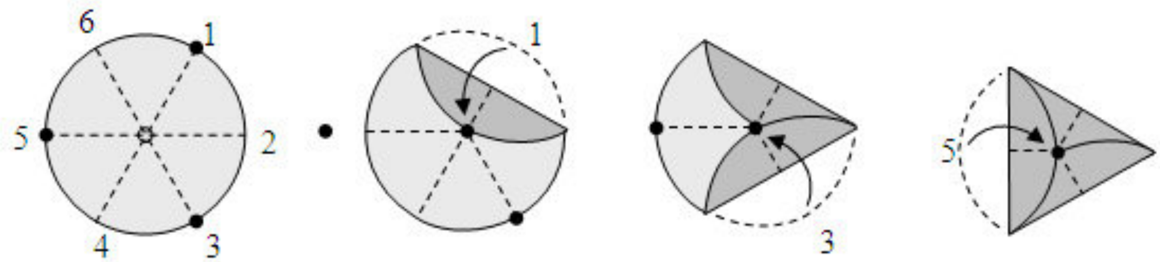
Make another circle and reform the same as the first. Join the 2 sets of 2 together attaching on the straight edges, the radii (same as with the single circle). Bobby pin them together similar to the individual circles. This forms a circular arrangement with a square interval.



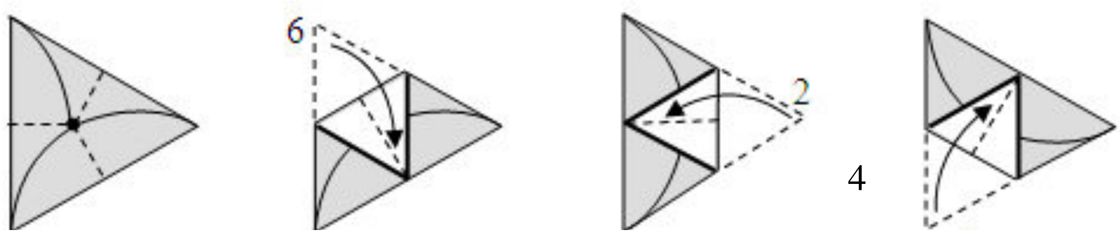
Next make another set of 2 circles as above; join them together in the same way, straight-edge-to-straight-edge, holding them together as before with bobby pins. This creates a tight and strong sphere of 8 open triangles alternating with and 6 open squares.

The vector equilibrium is traditionally called the cuboctahedron. There are 13 points of intersection (12 around 1) reflecting 7, the hexagon of 6 points around 1 in the center. There is much to be explored in this spherical form.

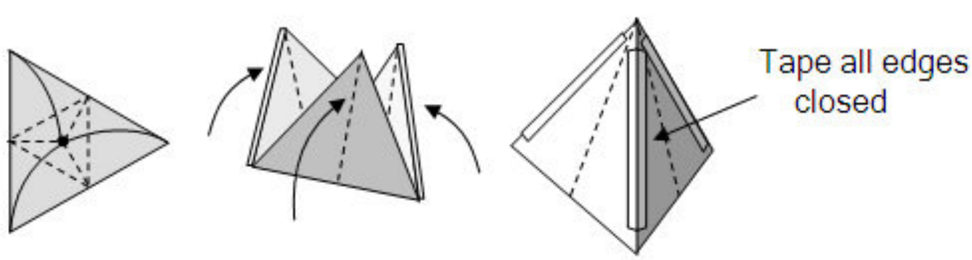
Fold A Tetrahedron



Start with folding 3 diameters. Fold 3 alternate points on circumference (1, 3, 5) to the center point. Crease well. Be accurate in putting the points to the center point otherwise creases will not be in the right place. This forms a 2-frequency equilateral triangle. Each edge length is divided in two equal parts. Like the circle, the triangle has 7 points, 6 on the outside and one in the center.

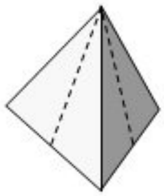


Fold each end point 6, 2, 4 to the midpoint on the opposite side and crease. Open each then fold the next. Do not over lap folding.

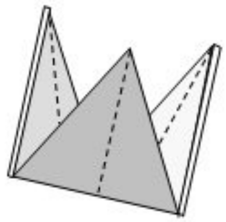


Bring the 3 end points together forming a <u>tetrahedron</u>. Tape full length along the edges to hold it together. This makes a “solid” form of the open tetrahedron in the first fold.

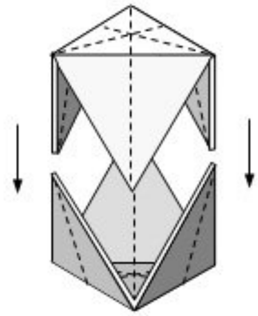
Fold An Octahedron



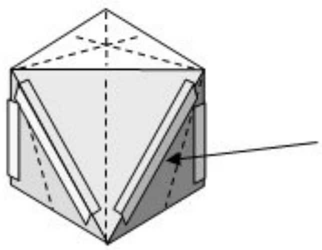
Fold a tetrahedron.



Open half way.

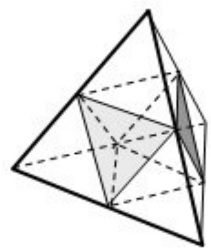


Put 2 open tetrahedra together.
The triangles of one will fit into the triangle spaces formed by the other.



Join the six edges with masking tape.

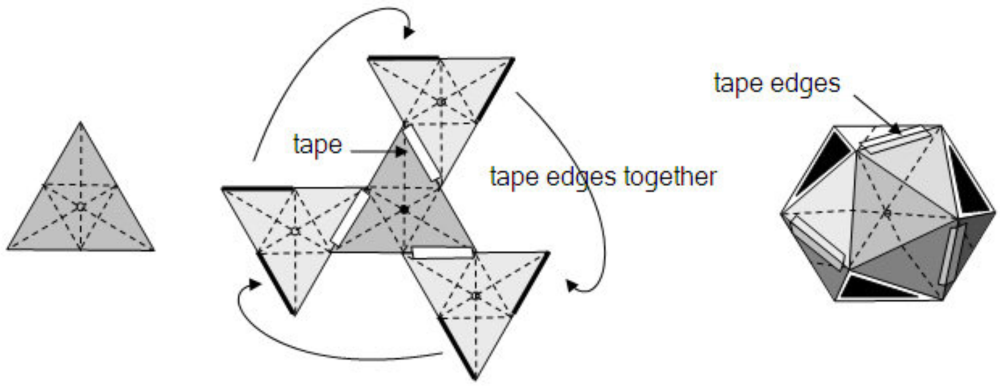
Four tetrahedra will fit around the octahedron forming a “solid” 2-frequency tetrahedron. Make the larger tetrahedron without the octahedron, leaving the center open, using only four tetrahedra.



Make two tetrahedra and open each so the triangular spaces are the same size as the triangles that form them. Join the 2 opened tetrahedra together, joining edge-to-edge. Tape the edges along the full length.

The square and triangle openings of the vector equilibrium sphere are the same as the surfaces of the tetrahedron and octahedron. They make a 3-component interrelated system where all edge, surface, and open spaces are congruent and fit together. Make multiples of each exploring the many ways they can fit together. There are other ways to reconfigure the circle using only these 9 creases; explore those possibilities of reforming the circles as well as various arrangements.

Fold An Icosahedron



Fold 4 tetrahedra, open them to flat triangle nets and arrange them showing 3 triangles around the center triangle. Off-set the 3 triangles by 1/2 edge length to the center triangle; tape half edge-to-half edge; tape both sides for added strength. Tape each of the three triangles in the same way as the center triangle, an alternating sequence of taped and un-taped edges. This forms 20 triangle planes, 16 are solid planes and 4 are open triangle planes. The 4 open planes are in a tetrahedron arrangement. This half edge arrangement can be right or left hand depending on which side of the center triangle they are placed. Each vertex point is surrounded by 4 closed triangle planes and one open triangle.

The tetrahedron, octahedron, and the icosahedron, 3 of the five Platonic Solids from triangles have been form by folding tetrahedra in a geometric progression, 1, 2, 4. The vector equilibrium is also in a geometric progression; 1 circle 2 tetrahedra, 2 circles 4 tetrahedra, 4 circles and 8 tetrahedra. The other two; the cube and the dodecahedron, can be modeled by folding and joining tetrahedra to stellate various arrangements on these three regular polyhedra.

This begins an endless process of forming, reforming, and joining multiples circles using 9 creases of the tetrahedron net generating many forms and systems not familiar in traditional geometry.