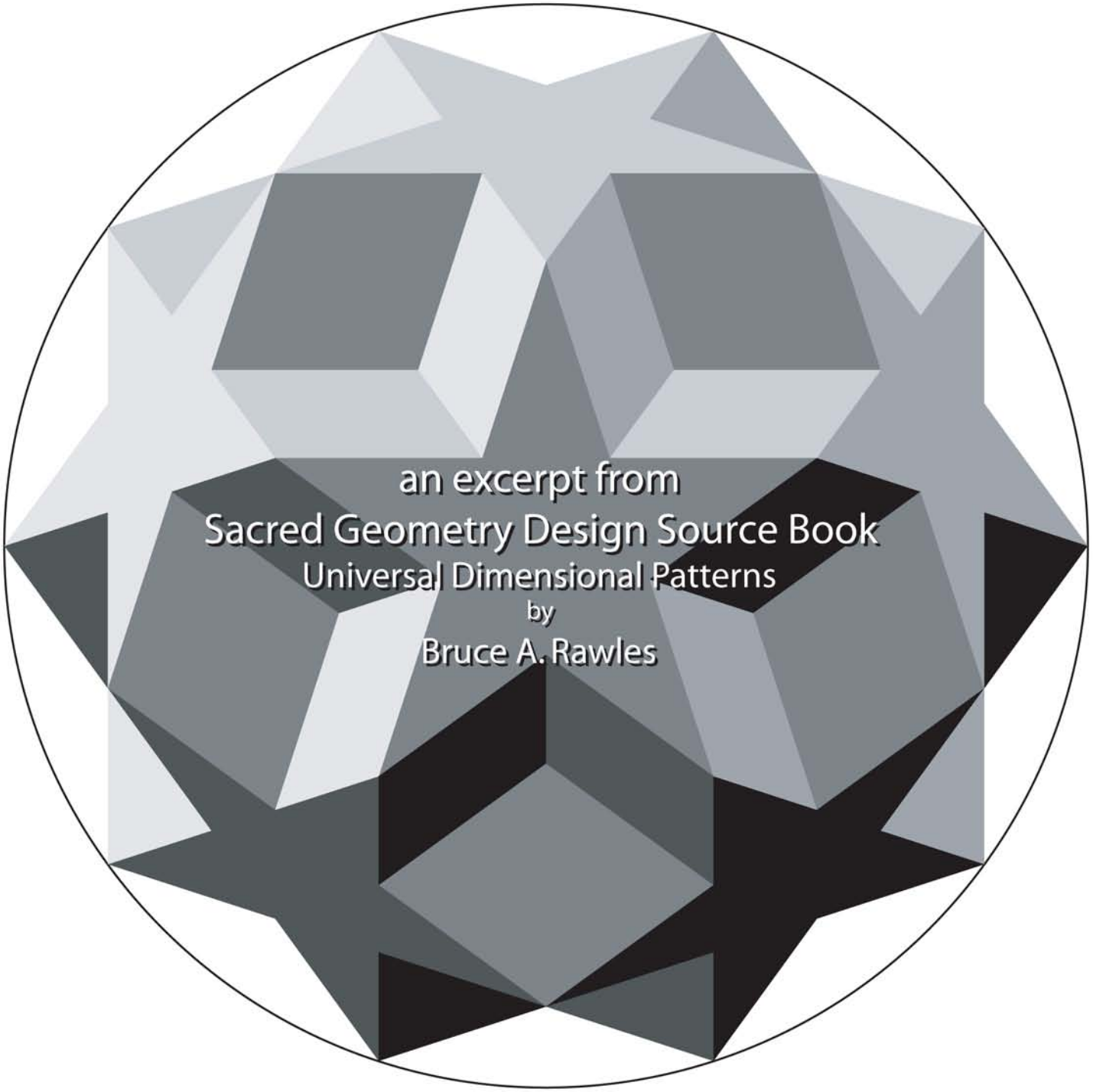
Platonic Solid
Fold Up Patterns
by
Bruce A. Rawles



an excerpt from
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Universal Dimensional Patterns
by
Bruce A. Rawles

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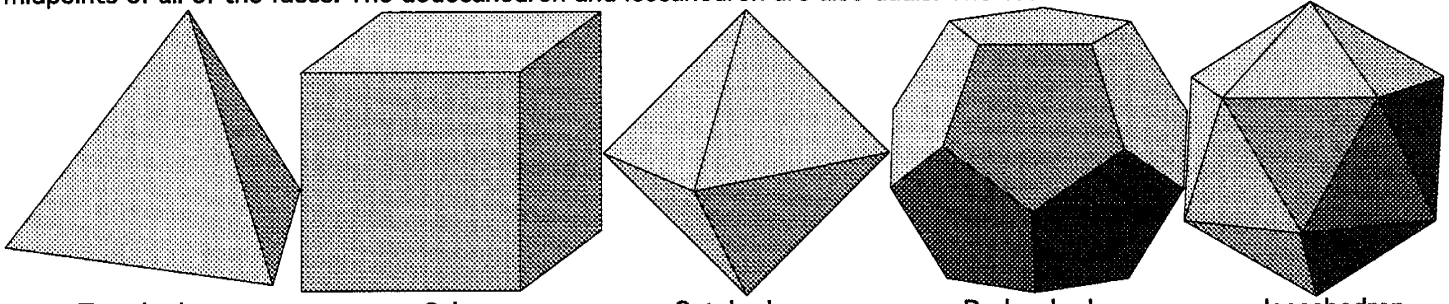
Platonic Solids & Archimedean Solids - Construction Suggestions:

To make the fold-up patterns for these polyhedra (the general name for these objects), cut out the large image in the center of the page along the heavy outer lines. Fold along the lighter, inner lines and tape together. To make polyhedra with a given edge size, or to fit inside or outside spheres, scale the images using the side length, circumsphere, or insphere radii, respectively. For example, scale the tetrahedron pattern (3.69" sides) by (4"(2√2)/√3)/3.69" = 1.77 or 177% to fit inside a 4" radius sphere.

The 5 Platonic Solids

Each of these solids are composed of identical regular polygons. The elements Plato ascribed to each of these are listed underneath the name of each solid. Hedron means surface (or in this context, polygon, and tetra means 4, hexa means 6, octa means 8, dodeca means 12 and icosa means 20; so these are 4, 6, 8, 12 and 20 polygon-sided objects, respectively. The cube and octahedron are duals, meaning that one can be created from the other by connecting the midpoints of all of the faces. The dodecahedron and icosahedron are also duals. The tetrahedron is a dual to itself.



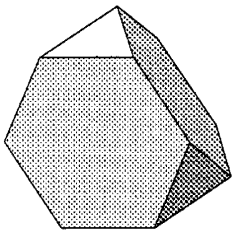
Tetrahedron
fire

Cube
(Hexahedron)
earth

Octahedron
air

Dodecahedron
spirit or ether

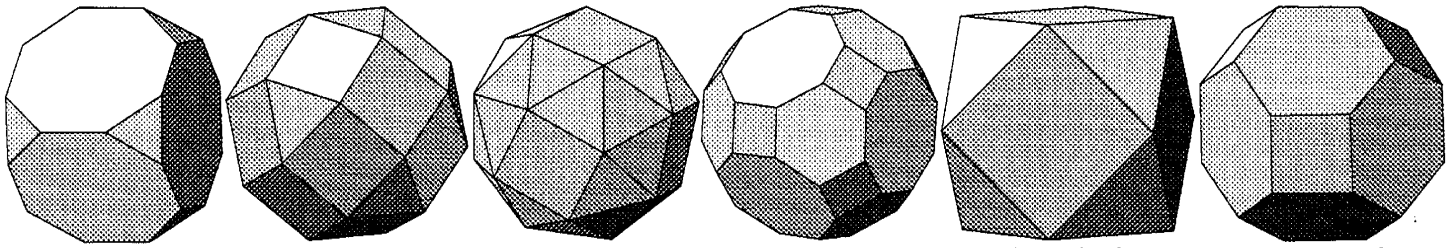
Icosahedron
water



Truncated
Tetrahedron

The 13 Archimedean Solids

These all have 2 or more types of regular polygons (e.g. triangles & squares).
The truncated tetrahedron shows the "progression" from a tetrahedron to another tetrahedron, since the tetrahedron is a dual to itself, i.e., connecting the midpoints of the faces yields another tetrahedron pointing in the opposite direction from the original.
The row below shows the progression from a hexahedron (cube) to an octahedron.
The bottom row shows the progression from a dodecahedron to an icosahedron, as corners are trimmed off and turned into other regular polygons.



Truncated
Cube

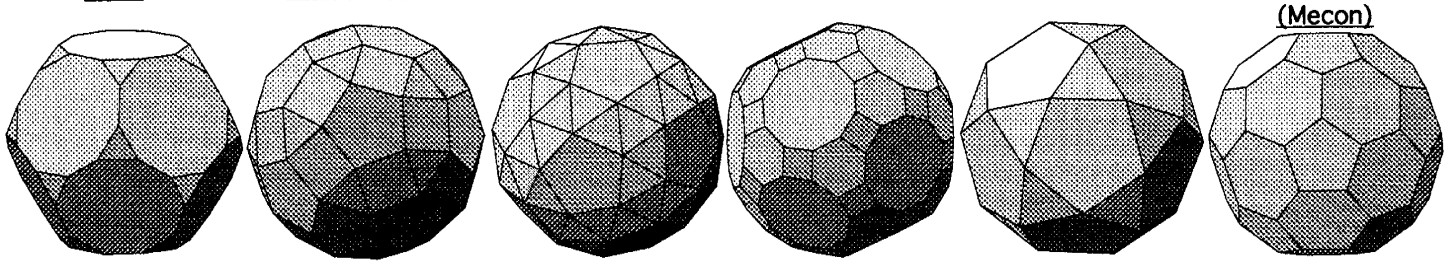
Rhombicub-
octahedron

Snub
Cube

(Rhombi)truncated
Cuboctahedron

Cuboctahedron
(Dymaxion)

Truncated
Octahedron
(Mecon)



Truncated
Dodecahedron

Rhombicosi-
dodecahedron

Snub
Dodecahedron

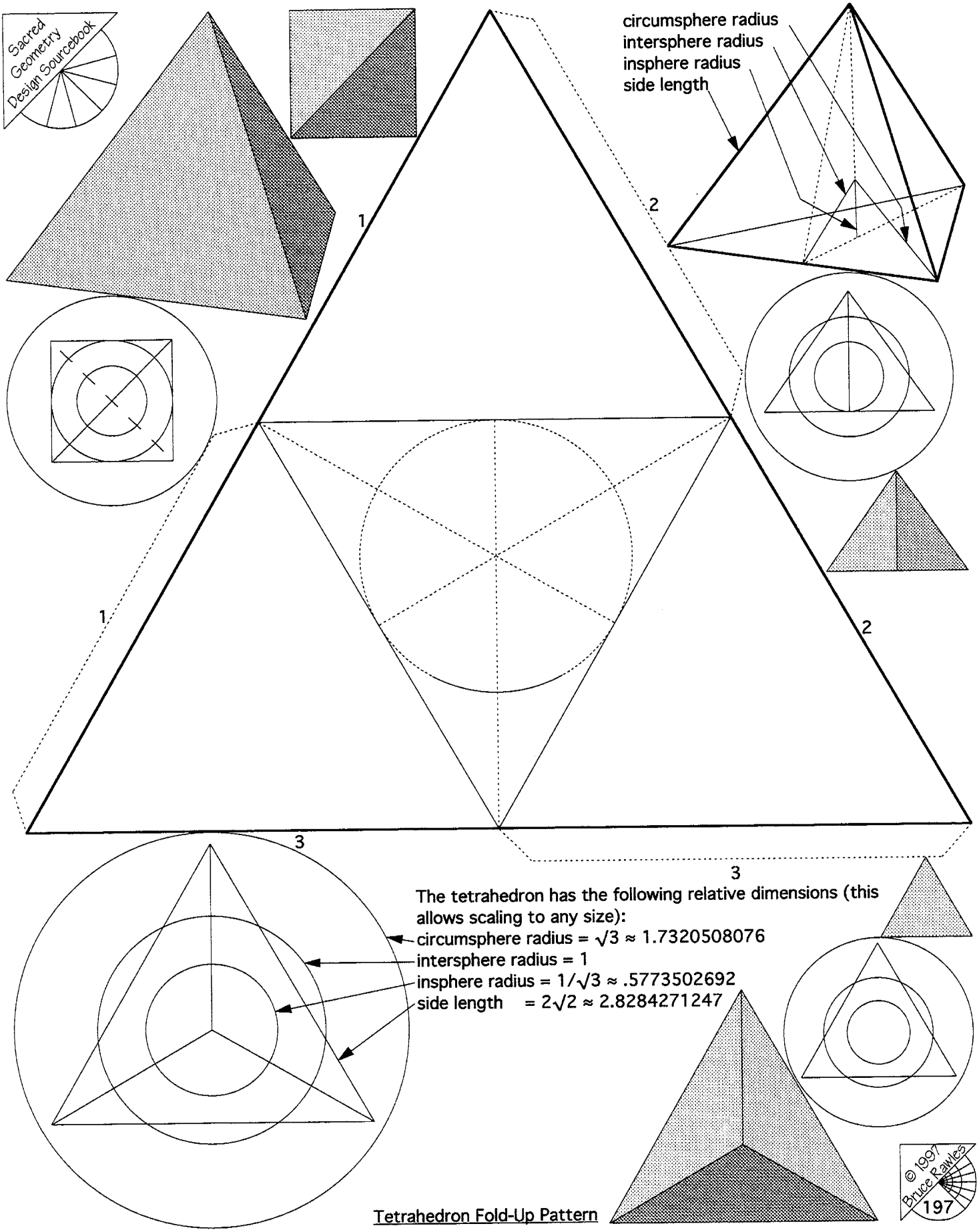
(Rhombi)truncated
Icosidodecahedron

Icosidodecahedron

Truncated
Icosahedron

The 5 Platonic Solids & 13 Archimedean Solids

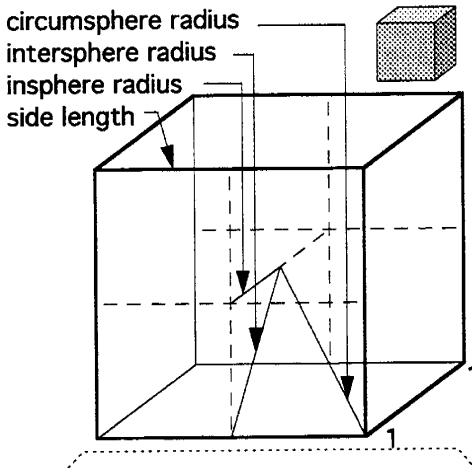
These are also known as convex polyhedra, as there are no hollow (concave) places on these shapes.

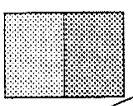


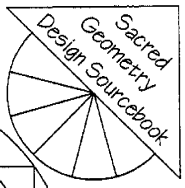
The tetrahedron has the following relative dimensions (this allows scaling to any size):

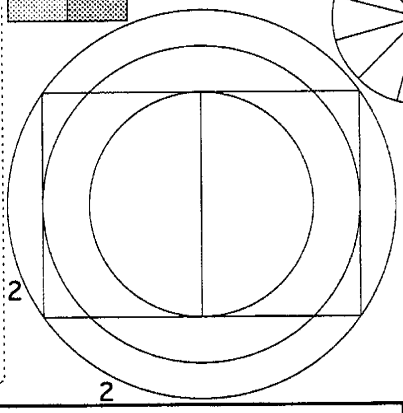
- circumsphere radius = $\sqrt{3} \approx 1.7320508076$
- intersphere radius = 1
- insphere radius = $1/\sqrt{3} \approx .5773502692$
- side length = $2\sqrt{2} \approx 2.8284271247$

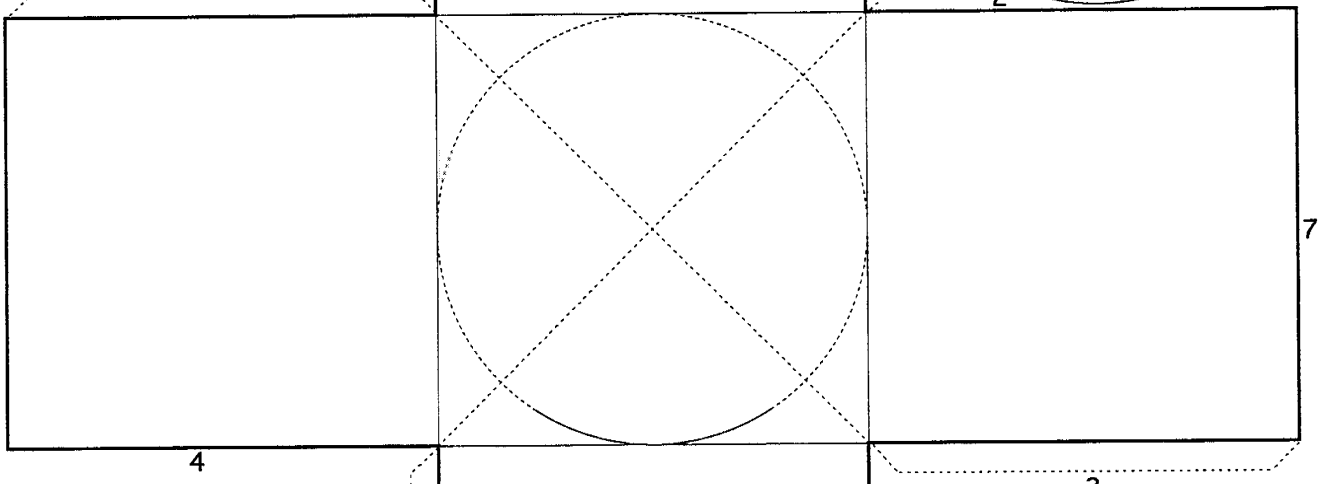
Tetrahedron Fold-Up Pattern

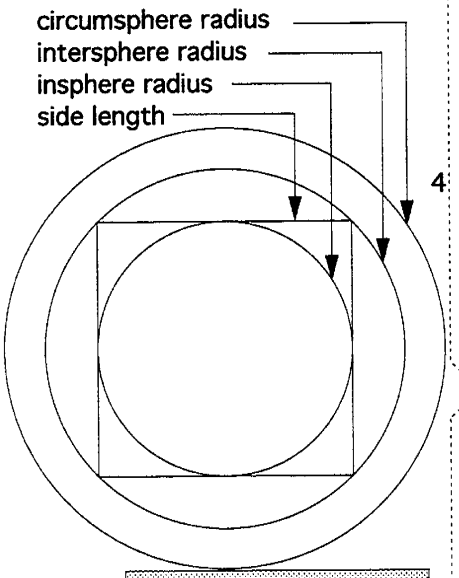




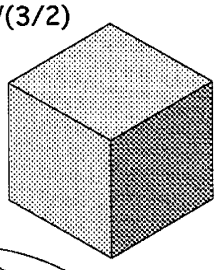


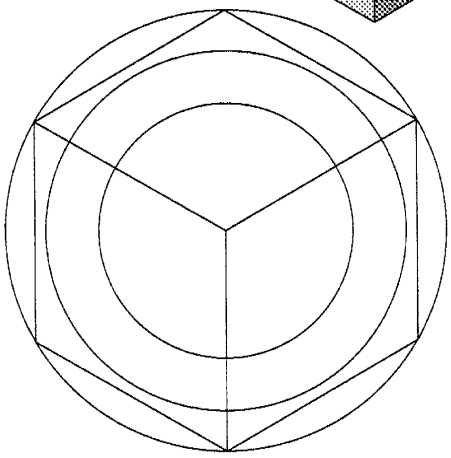


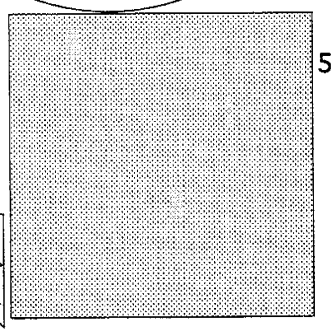




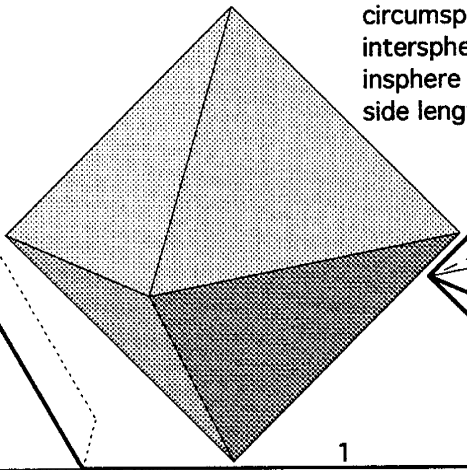
The cube (hexahedron) has the following relative dimensions (this allows scaling to any size):
circumsphere radius = $\sqrt{(3/2)}$ ≈ 1.2247448714
intersphere radius = 1
insphere radius = $1/\sqrt{2}$ ≈ .7071067812
side length = $\sqrt{2}$ ≈ 1.4142135624

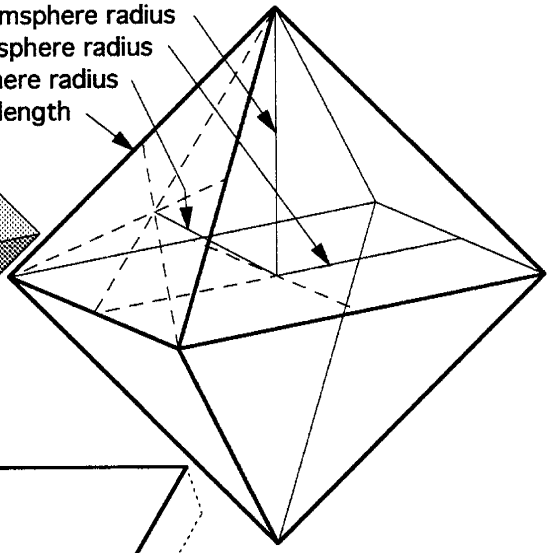




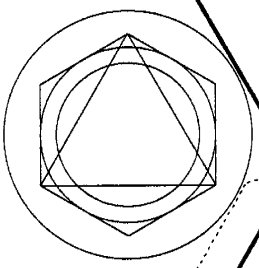


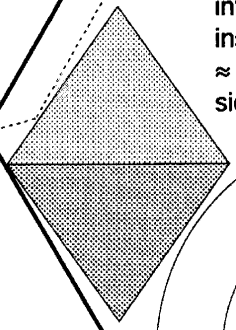
Cube (Hexahedron) Fold-Up Pattern

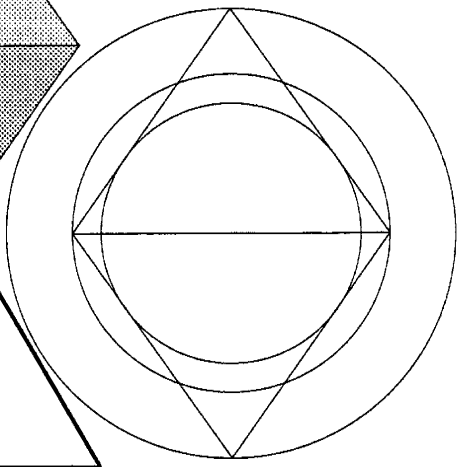


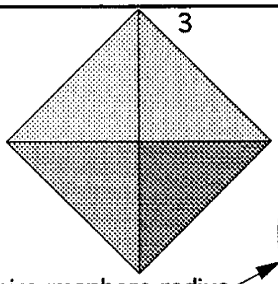


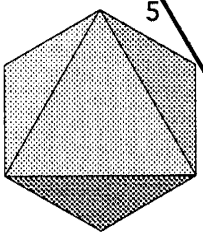
The octahedron has the following relative dimensions (this allows scaling to any size):
circumsphere radius = $\sqrt{2}$
$\approx$ 1.4142135624
intersphere radius = 1
insphere radius = $\sqrt{(2/3)}$
$\approx$ .8164965809
side length = 2

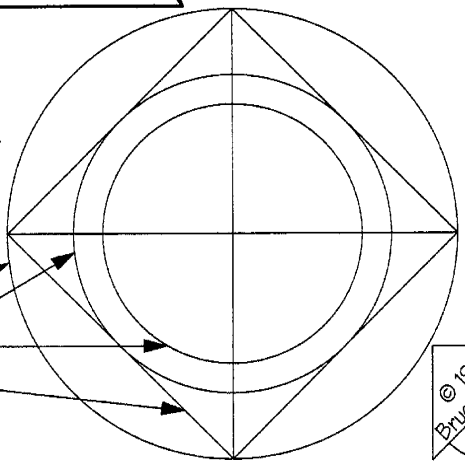






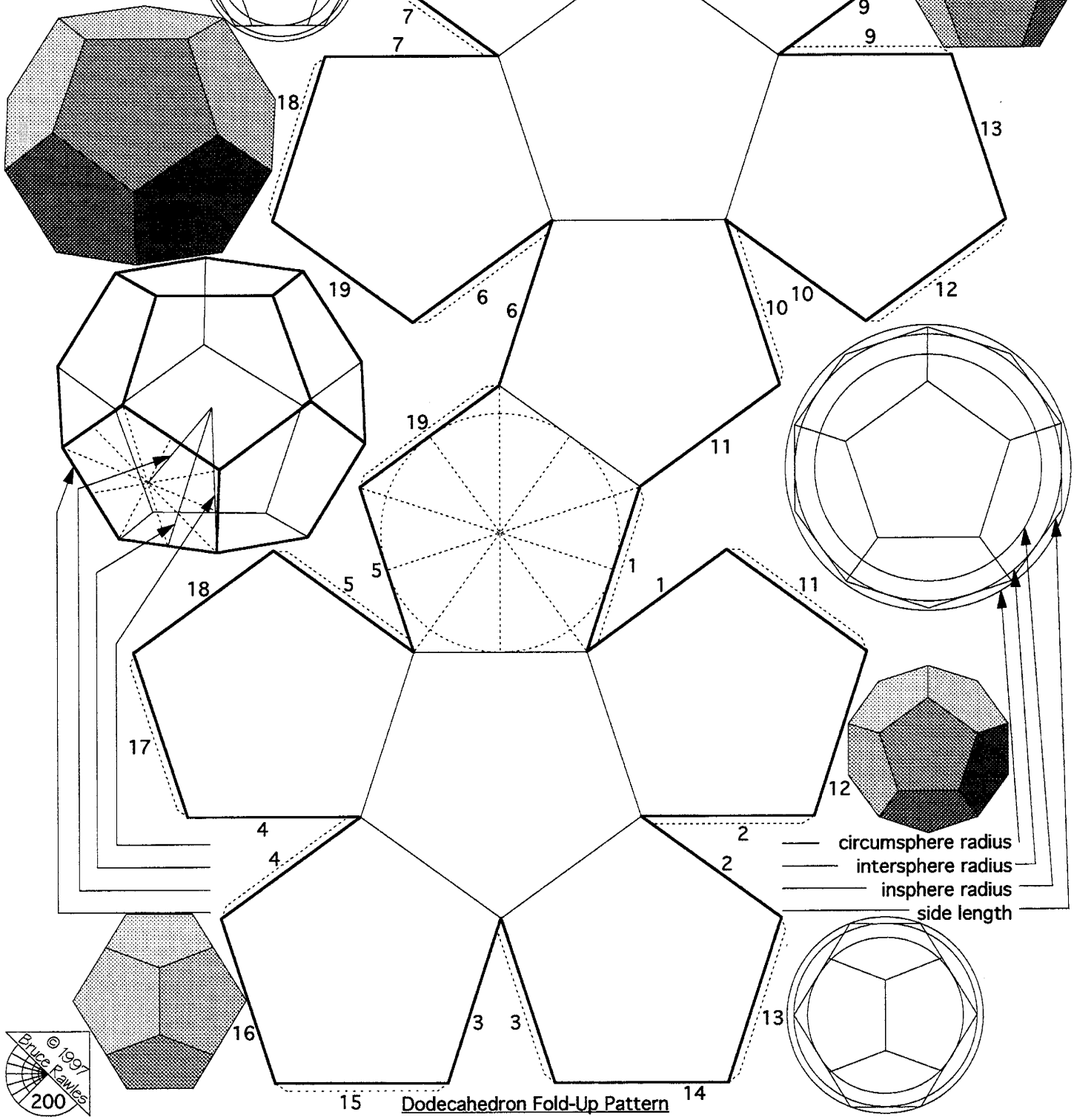




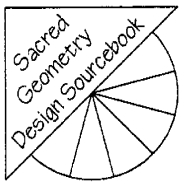


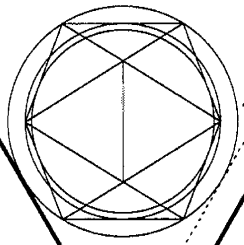
Octahedron Fold-Up Pattern

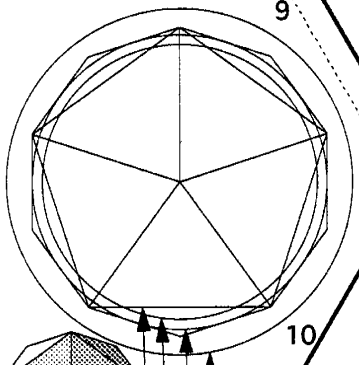
The dodecahedron has the following relative dimensions (this allows scaling to any size):
circumsphere radius = $(\sqrt{(18-6\sqrt{5})})/2$
≈ 1.070466269
intersphere radius = 1
insphere radius
$= (1+\sqrt{5})/\sqrt{(10+2\sqrt{5})}$
$\approx .8506508084$
side length = $3 - \sqrt{5}$
$\approx .7639320225$

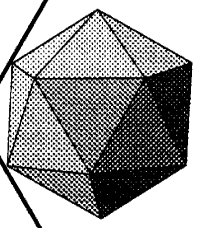


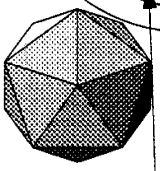
Dodecahedron Fold-Up Pattern

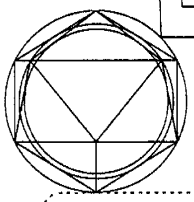


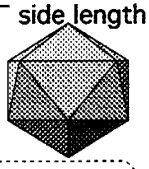


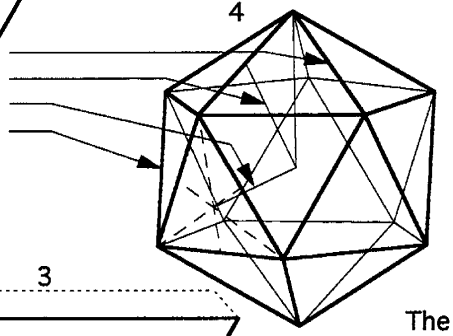




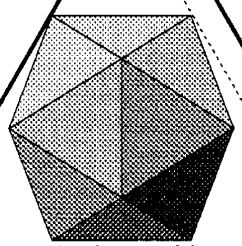








circumsphere radius
intersphere radius
insphere radius
side length



The icosahedron has the following relative dimensions (this allows scaling to any size):
circumsphere radius = $\sqrt{(10+2\sqrt{5})/(1+\sqrt{5})} \approx 1.1755705046$
intersphere radius = 1
insphere radius = $\sqrt{(\emptyset+(2/3))/\emptyset} = (2\sqrt{((7+3\sqrt{5})/6)})/(1+\sqrt{5}) \approx .9341723590$
side length = $2/\emptyset = 4/(1+\sqrt{5}) \approx 1.2360679775$;
{where $\emptyset = (1+\sqrt{5})/2$}

Icosahedron Fold-Up Pattern

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