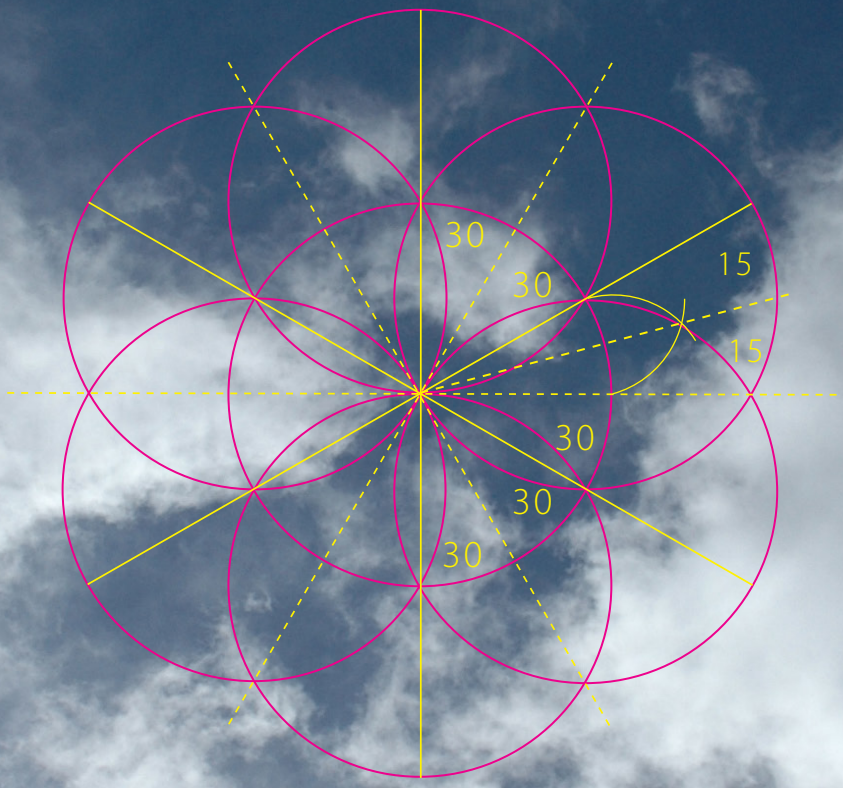
Drawing Daisy Wheel Angles and Triangles



Laurie Smith
THE**GEOMETRICAL**DESIGN**WORKS**

Laurie Smith is an independent early-building design researcher, specialising in geometrical design systems. Because geometry was part of the medieval educational curriculum he uses geometrical analysis to excavate and recover the design methodologies of the past, a process he thinks of as design archaeology. He lectures, writes and runs practical workshops on geometrical design and publishes his work through his website THE**GEOMETRICAL**DESIGN**WORKS**.

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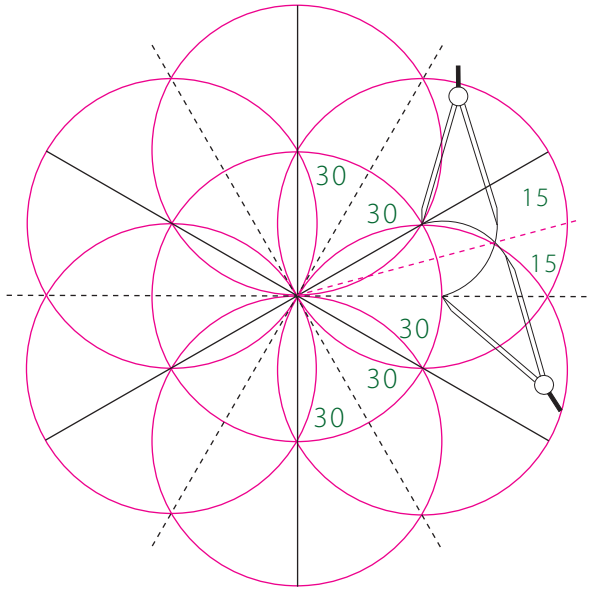
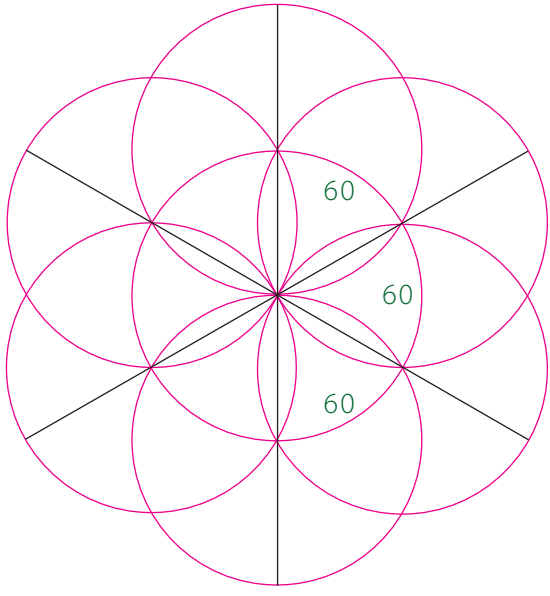
THE**GEOMETRICAL**DESIGN**WORKS**



Drawing Daisy Wheel Angles and Triangulation

The daisy wheel is easy to construct using a compass or dividers. Draw a circle at the centre of a horizontal line and draw two more from where the line is cut by the circle. The resulting three circles intersect at four points, two above and two below the horizontal line. Draw four more circles from these points so that there are six circles around the circumference of a seventh.

The symmetry is automatic, dividing the central circle into six equal 60° sectors. Connecting the six petal tips generates a hexagon which can be found in nature in the hexagonal structure of a bee's honeycomb cells and in the six-armed radial patterns of snowflakes. The wheel can also be used to construct a range of angles and equilateral triangulations.



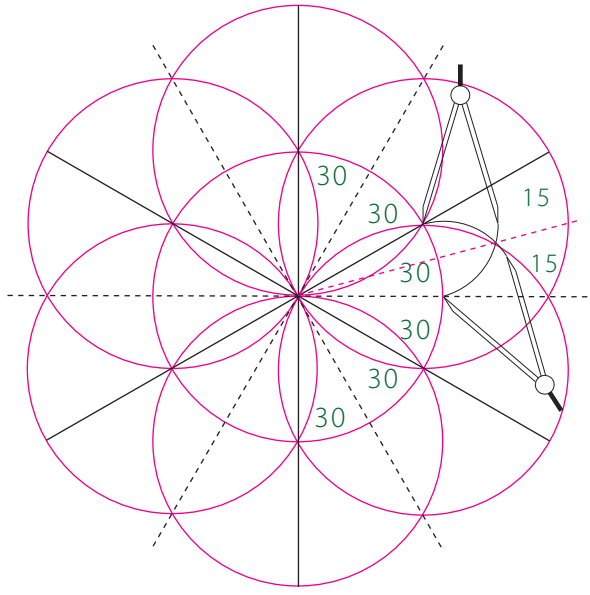
1

Drawing the Daisy Wheel's radial angles

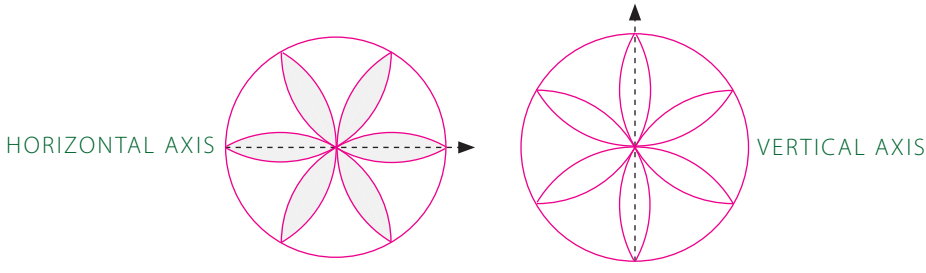
1 Draw the full daisy wheel of seven complete circles on a vertical centre line to generate the familiar six petals within the central circle. Bisect the petals to give the wheel's three major diameters that intersect at the wheel's axis. The three diameters can be seen, alternatively, as six radii radiating from the wheel's axis. *It is a common characteristic of geometry, that constructions can often be seen in more than one way.* There are six angles between the radii, all identical at 60°, so the full wheel gives 360°.

2 A further three diameters, shown in dashed line, can be drawn through the intersections of the six outer circles. These lines bisect the 60° angles to give twelve 30° angles around the wheel. The 30° angles can be halved to 15° in turn using dividers from either side of the angle at the central circle's circumference. Further divisions can be made in the same way to 7½°, 3¾°. The bisections subdivide the wheel into 6, 12, 24, 48 and 96 sectors, the larger numbers being found in the radials of rose windows.

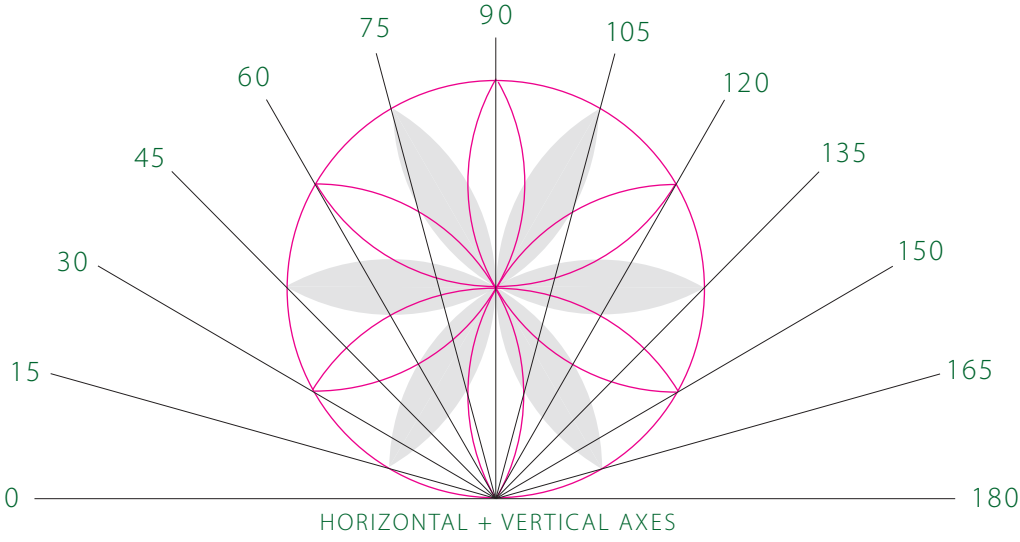
3 The daisy wheel can be drawn on either vertical or horizontal axes to give six petal constructions. Combining both axes gives a twelve petal configuration. Lines drawn from the lowest petal tip through each of the remaining eleven produces a 180° protractor with twelve 15° intervals.


30
30
30
30
30
30
15
15

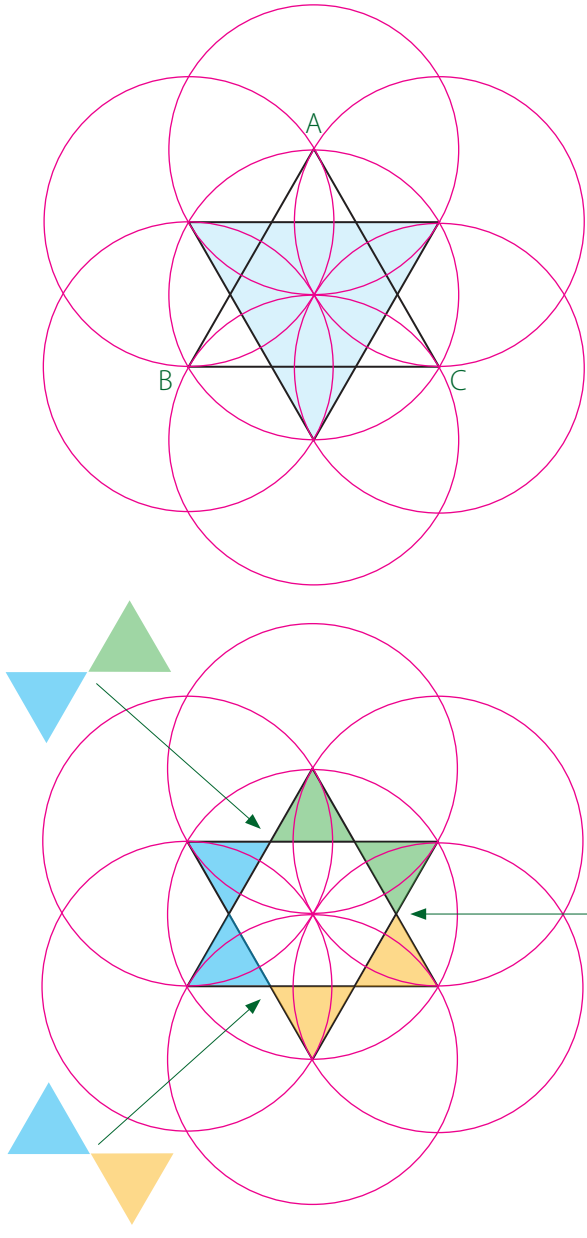
2


HORIZONTAL AXIS
VERTICAL AXIS

3


0
15
30
45
60
75
90
105
120
135
150
165
180
HORIZONTAL + VERTICAL AXES

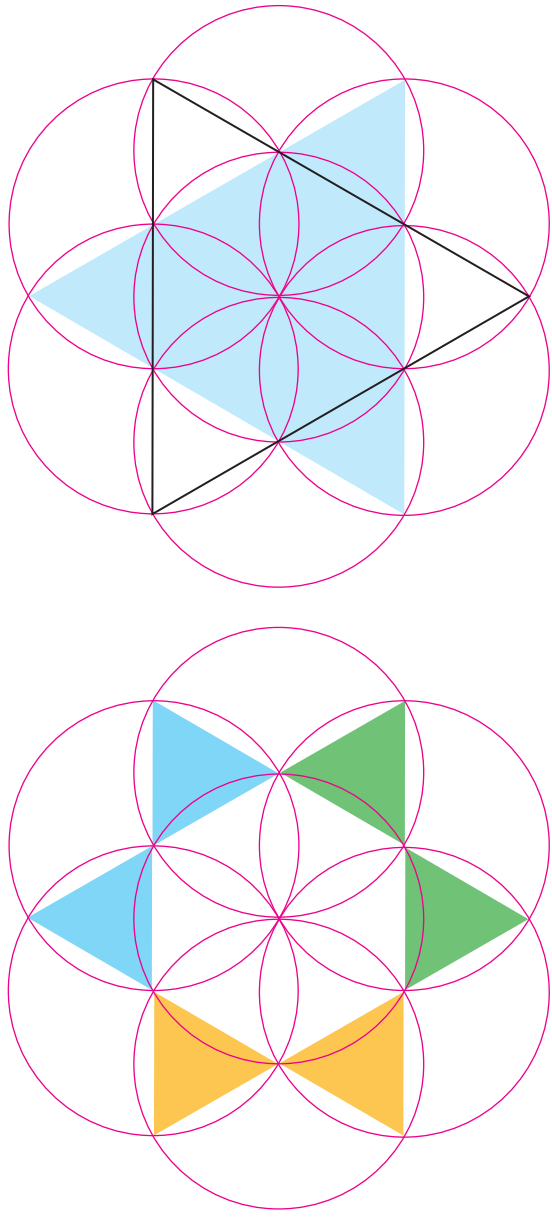
3



1

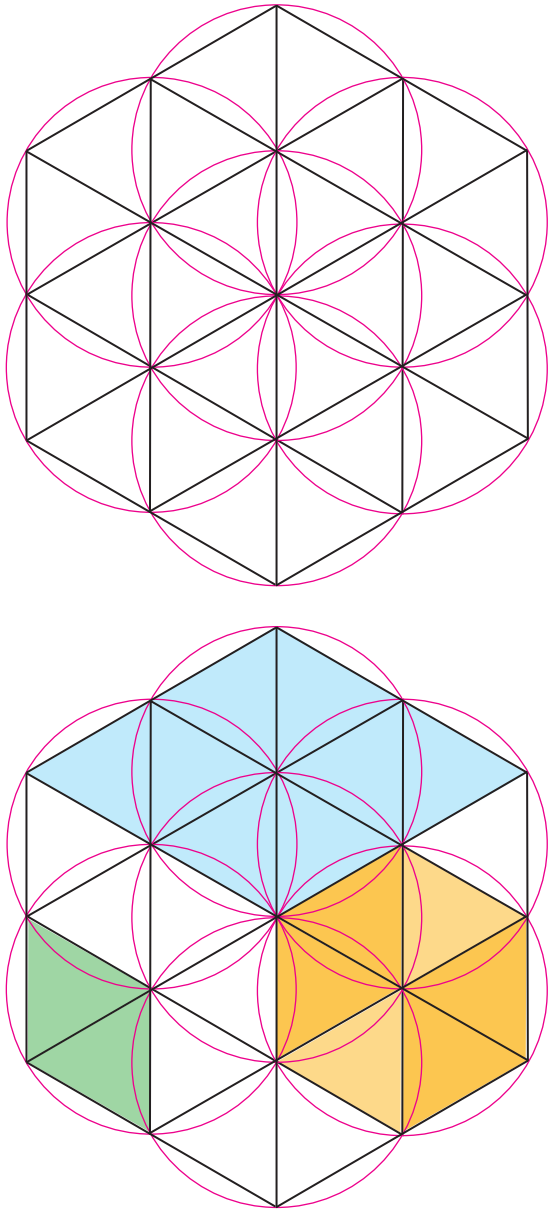
Drawing Equilateral Triangles

1 Connecting alternate petal tips A B C generates an equilateral triangle. Connecting the remaining three tips gives a second equilateral, identical in triangulation but facing in the opposite direction. The two equilaterals combine in the Star of David. The star generates numerous other triangulations in symmetrically juxtaposed pairs.



2

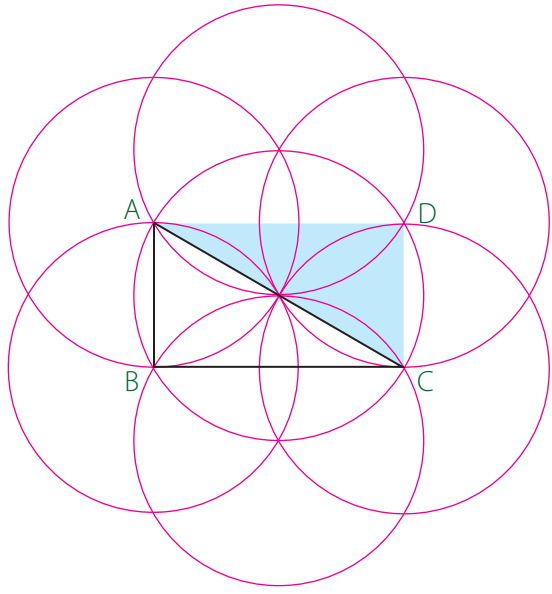
2 Equilaterals can also be constructed using the daisy wheel's outer circles, their directional orientation rotated through 30° in relation to the triangles shown in drawing 1. Similarly, larger pairs of symmetrically juxtaposed triangles can be drawn from the circumference of the wheel's central circle. These are also rotated through 30°. It is common in geometrical constructions that a change in scale brings a change in directional orientation. Note the hexagons at the centres of the wheels.



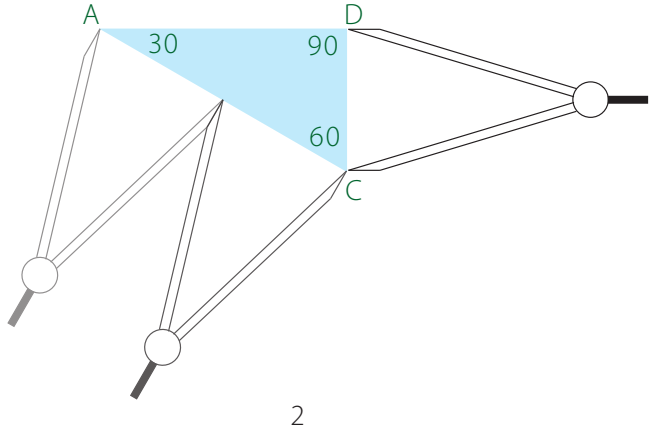
1

Drawing an Equilateral Triangulated Grid
with Diamond and Hexagon by-products

1 Drawing parallel lines through all of the daisy wheel's intersections generates an equilateral triangulated grid within a large hexagon. The grid yields three large diamonds, seven medium hexagons, and twenty-four small diamonds. The three large diamonds simulate a cube in three dimensional perspective.



1



2

Drawing a Right Angle with Harmonic Proportions

1 Connecting two petal tips A B to C on the opposite side of the wheel, or CD to A, generates a right angle at B and D.

2 The right angled triangle defined within the daisy wheel has the harmonic angles 30° 60° 90° and the harmonic ratio of 1 : 2 between its short side and long side (which is the diagonal of the rectangle ABCD in diagram 1). The dividers show why: the long side equals the daisy wheel's central circle diameter and the short side equals the distance between two adjacent petal tips, all of which are one radius apart. 2 radii = 1 diameter.

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