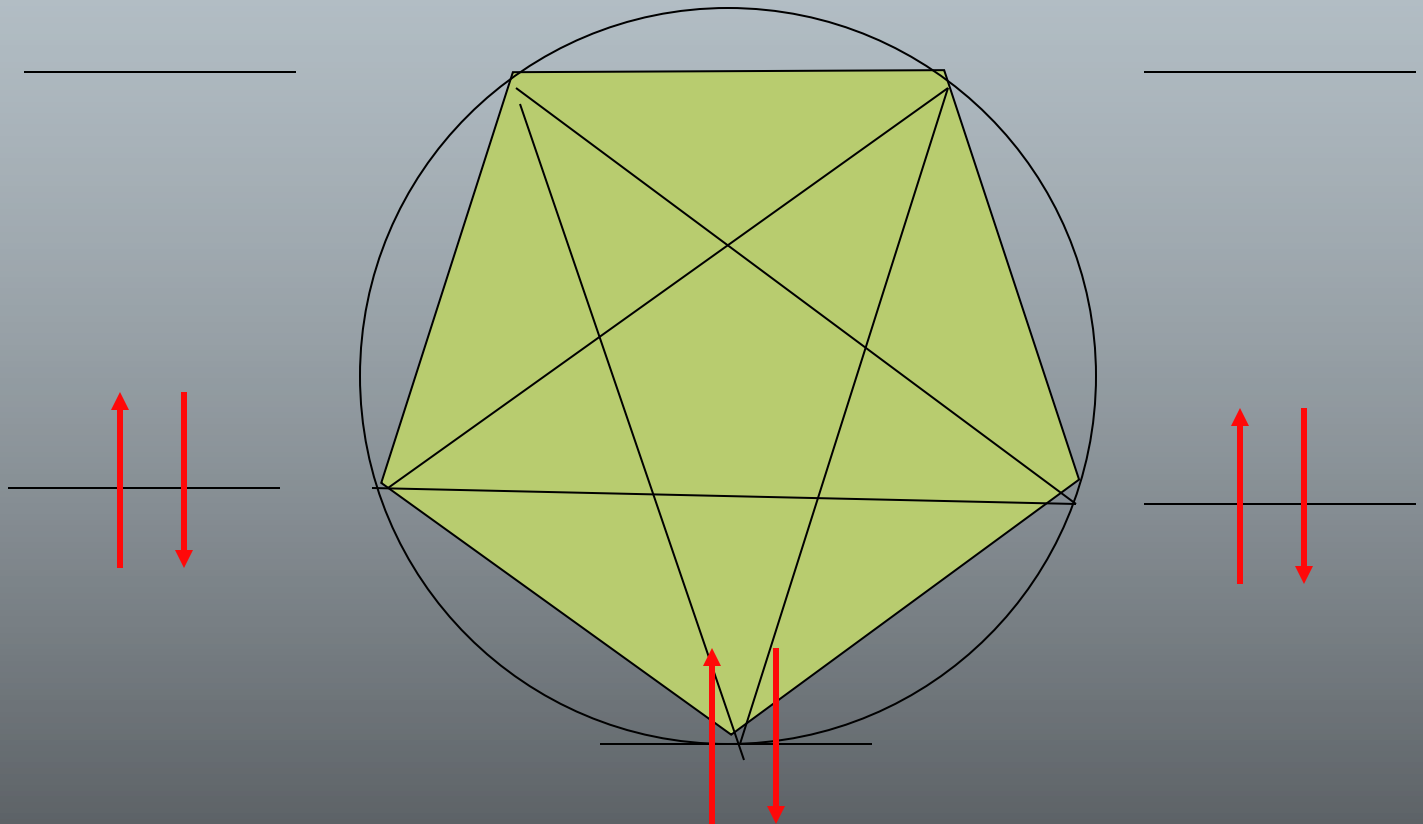
Aromaticity, the DaVinci Code and the Golden Section



A Regular Pentagon has Internal Angles of 108°

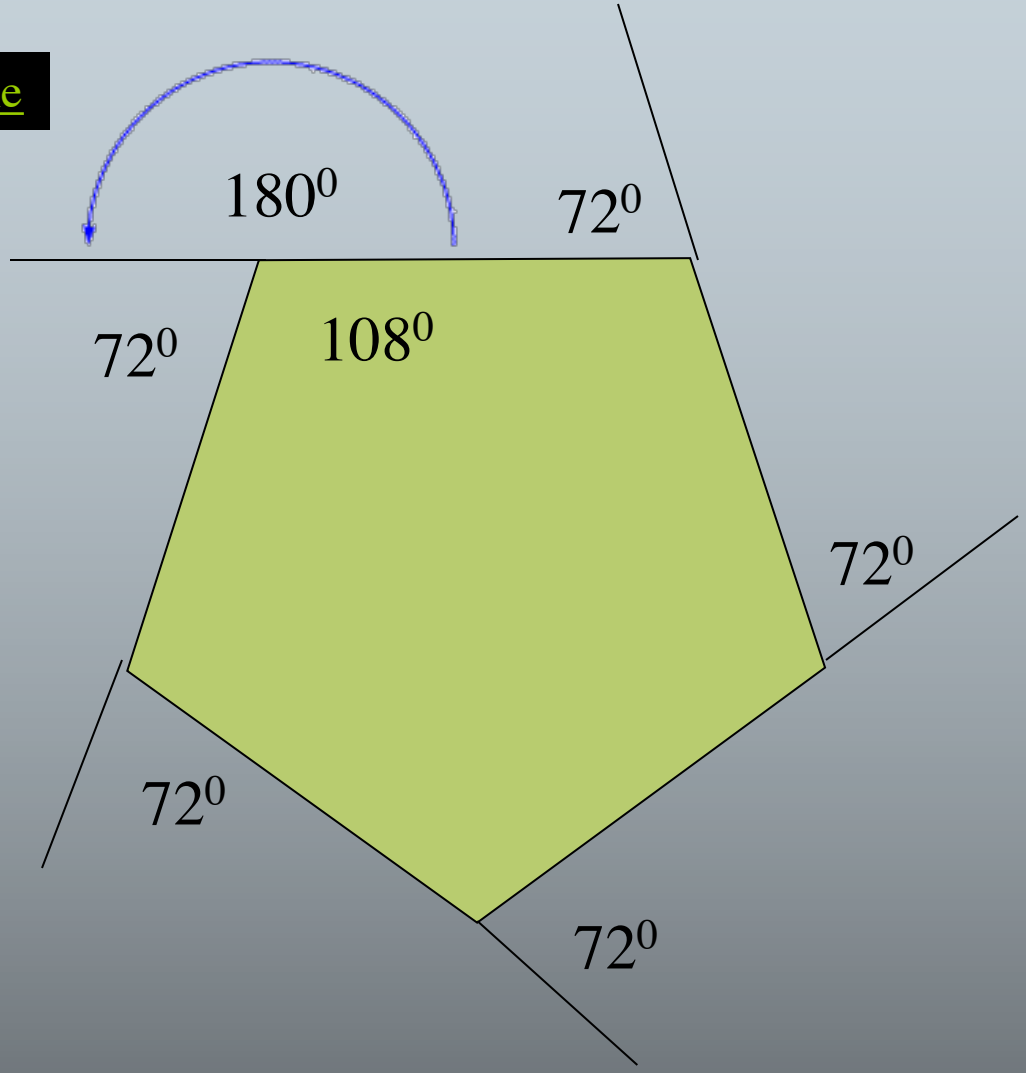
Baeyer's assumption about cyclopentane

The sum of all supplementary angles in any polygon equals 360°.

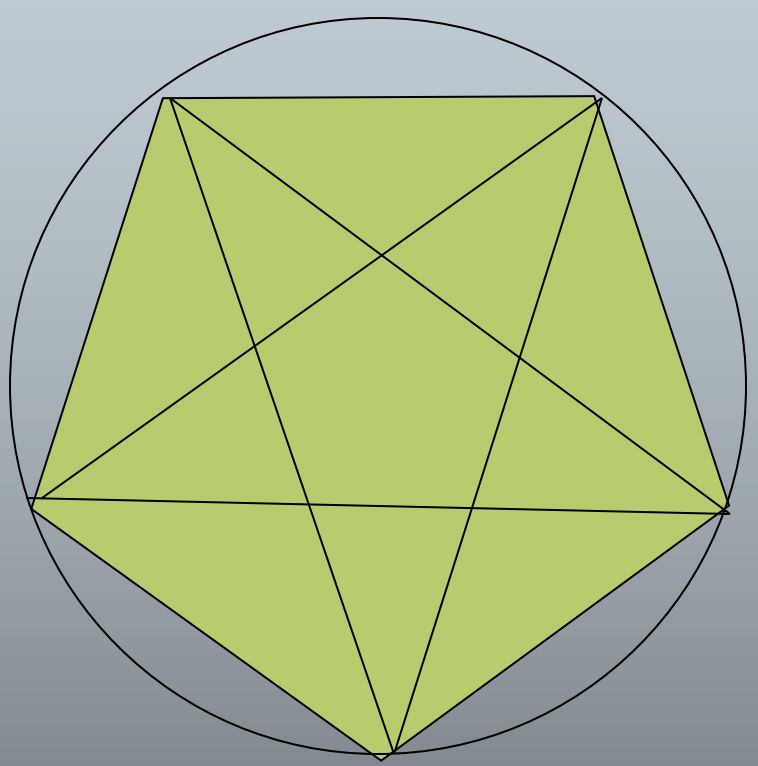
In a regular pentagon each supplementary angle equals 72°.

Thus 180° - 72° = 108°

Where Baeyer went wrong.



A regular pentagon can be inscribed in a circle.

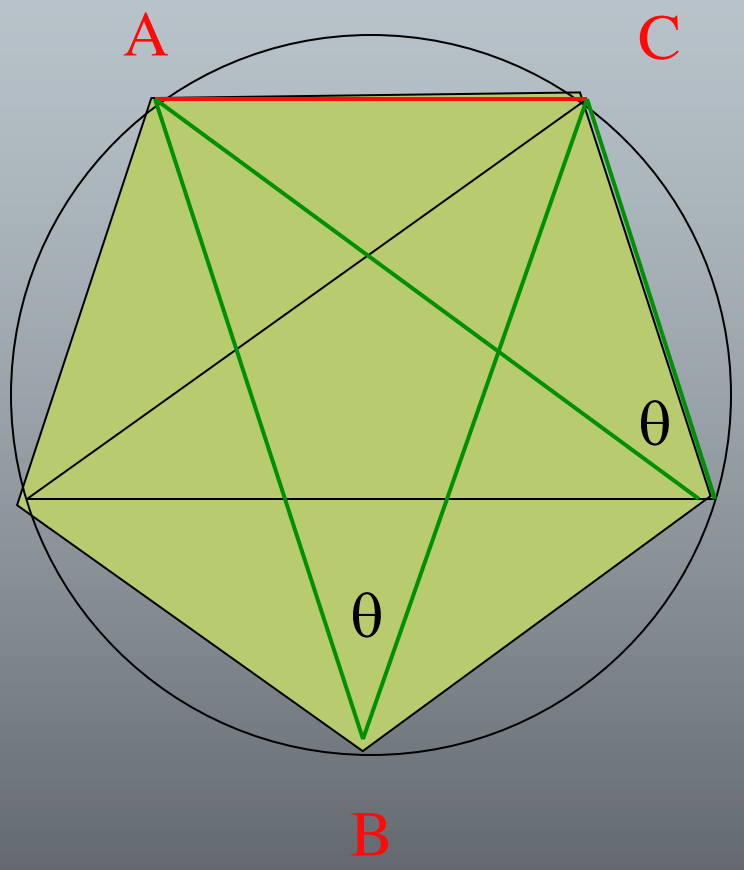


Connecting alternate vertices of a pentagon produces the pentacle, a figure imbued with mysticism.

The Da Vinci Code

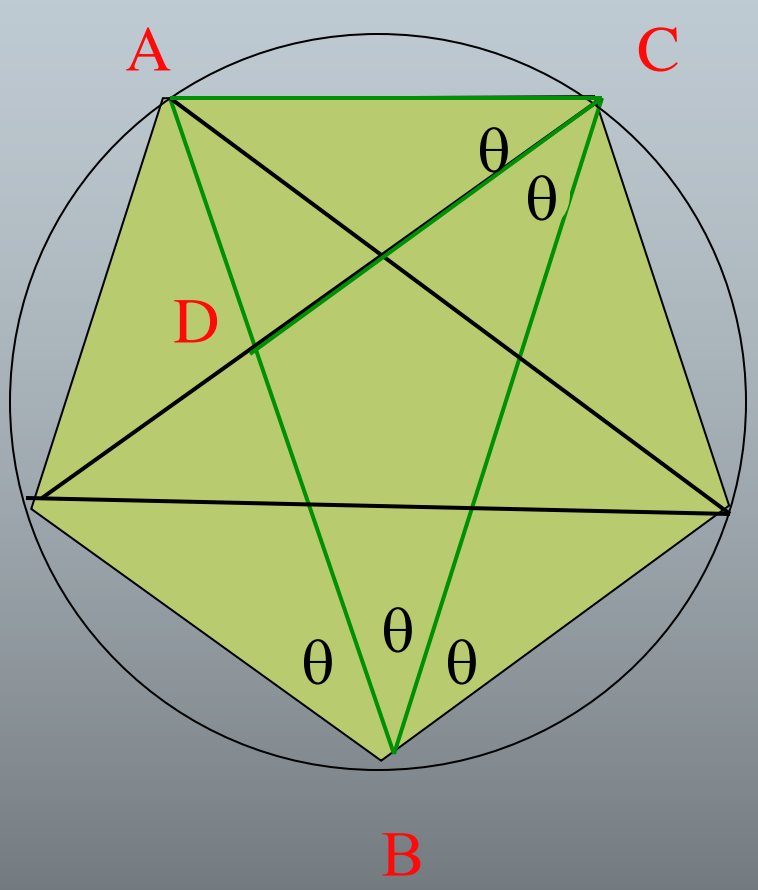
Angles Subtending a Chord (Arc)

Two line segments that subtend the same chord and meet on the circle have the same angle.



Similar Isosceles Triangles

The interior angles (108°) of the pentagon are trisected into angles θ = 36°



The Golden Section

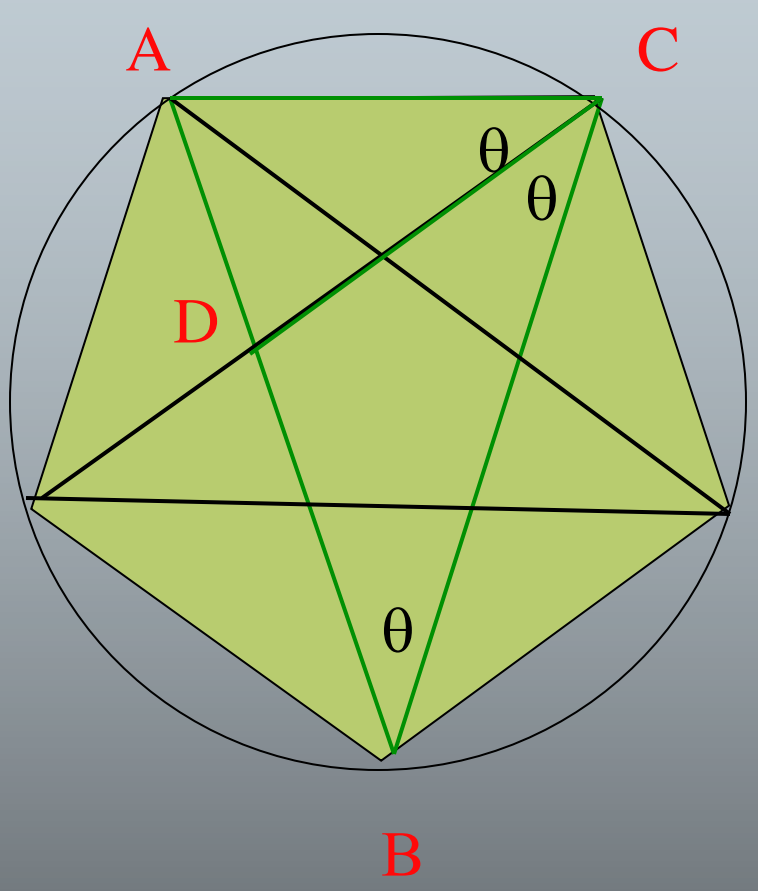
ΔACD is similar to ΔABC with base angles of 2θ

and line AC = CD = BD = x

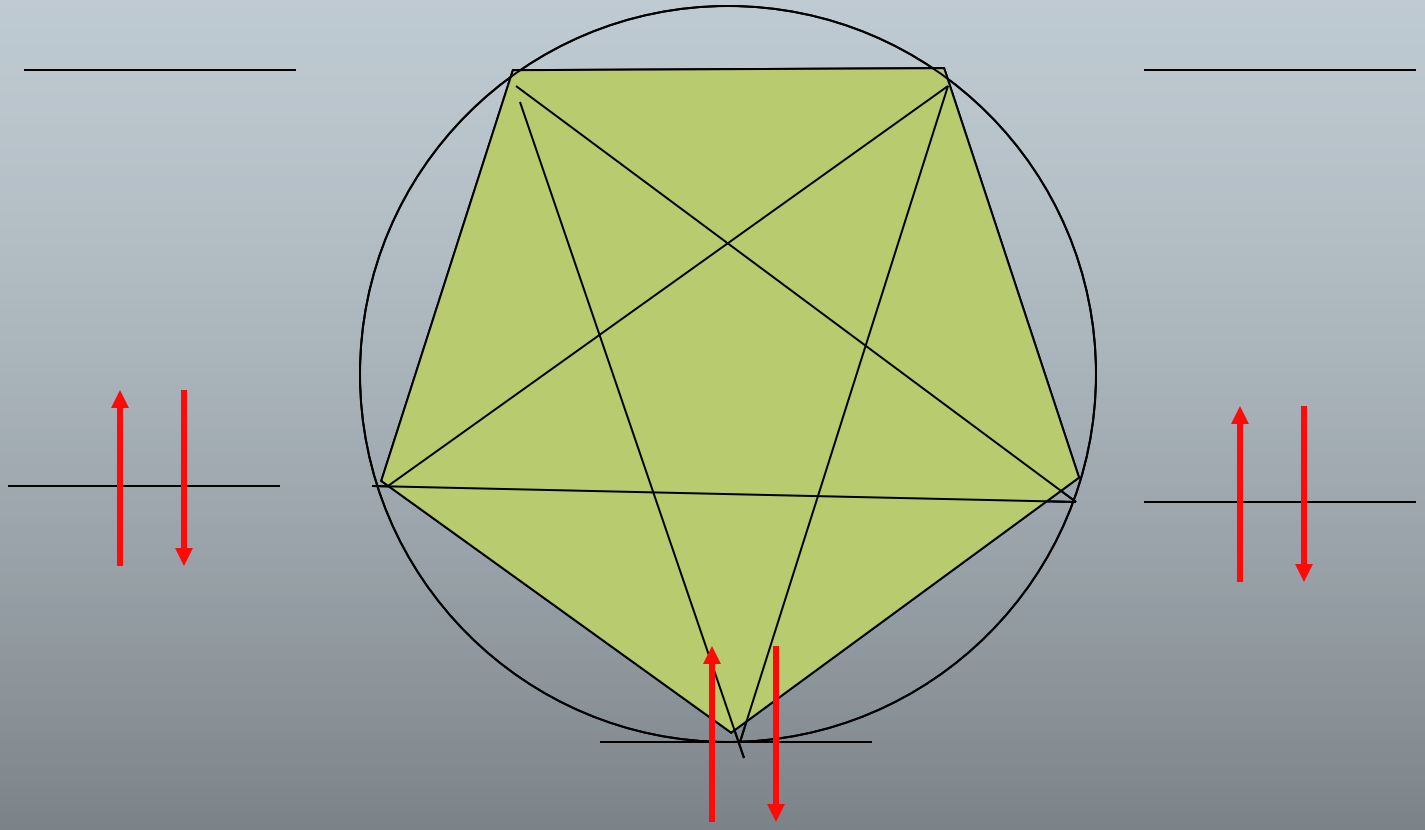
If AB = 1, then AD = 1- x

x/1-x = 1/x or $x^2 + x - 1 = 0$

x = 0.618 and 1/x = 1.618 for positive values.

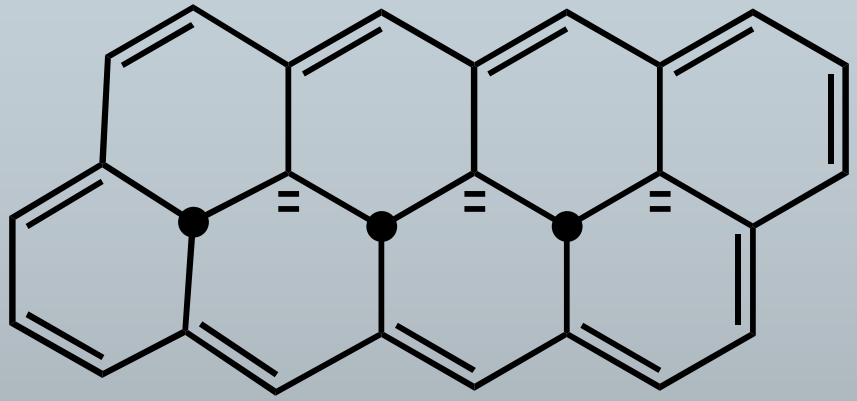


Cyclopentadienyl anion



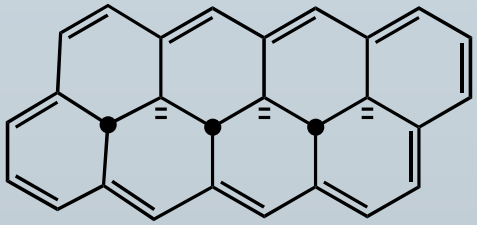
Aromaticity Meets the Da Vinci Code

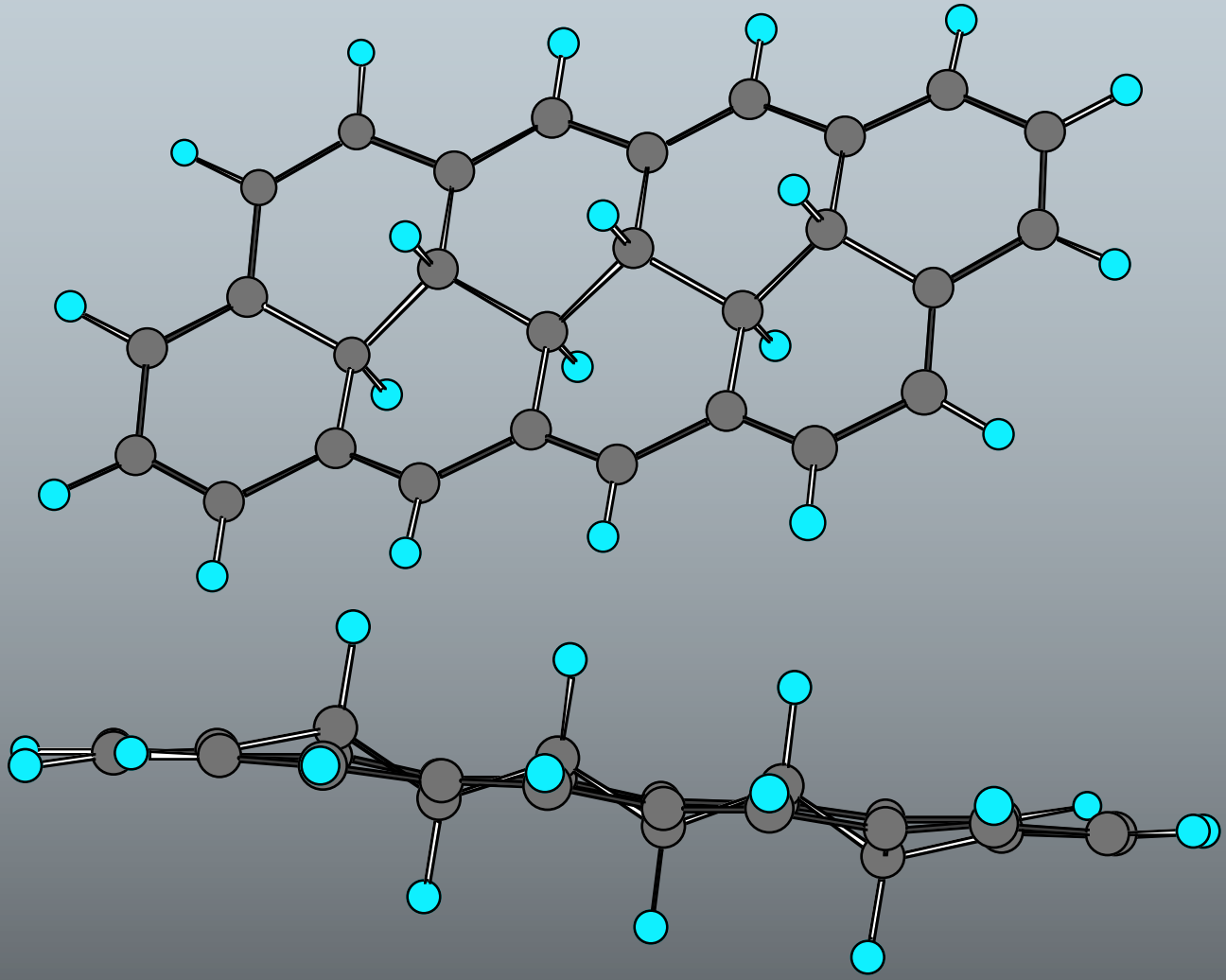
Am I Aromatic?



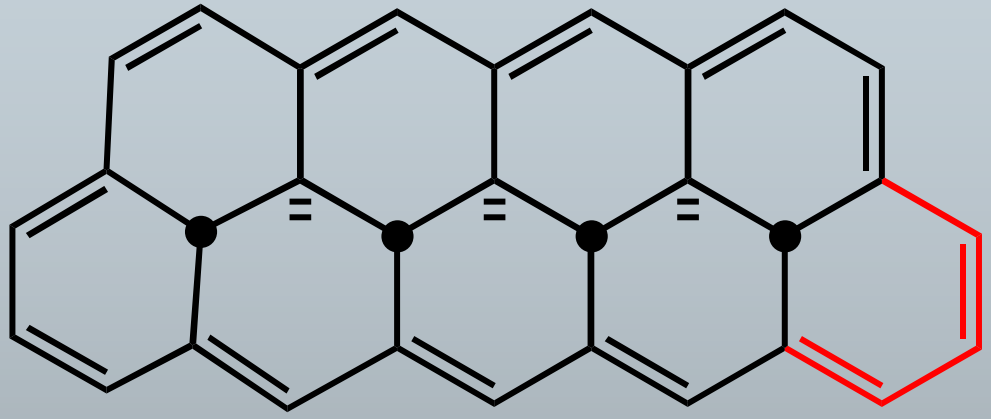
- planar π-system
- cyclic array
- 10 double bonds; 20 electrons; 4n
- No!

A Closer Look





Am I Aromatic?

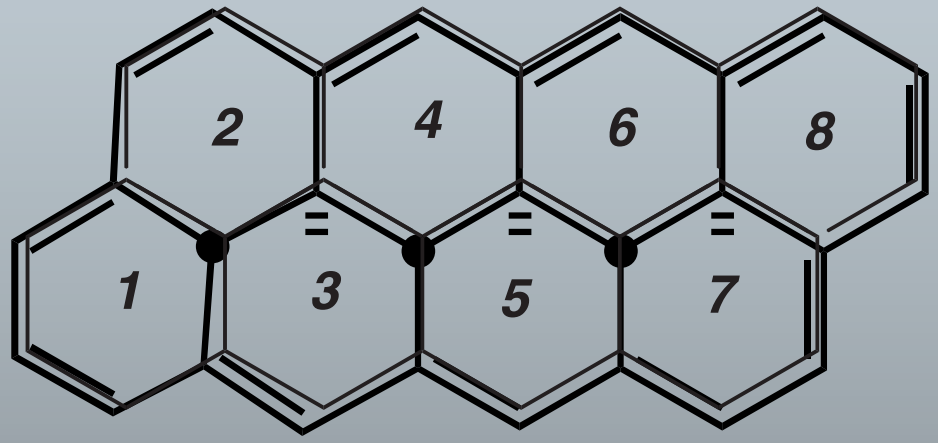


- planar π-system
- cyclic array
- 11 double bonds; 22 electrons; 4n + 2
- Yes!

The Bee Hive

The bee can enter any cell but it must enter at cell 1 and then to subsequent contiguous cells in ascending numerical order.

Cell	Routes
1	1
2	1
3	2
4	3
5	5
6	8
7	13
8	21



Cell 4: 1-2-4; 1-3-4; 1,2,3,4 but not 1,3,2,4

The route to a given cell is the sum of the routes to the two previous cells.

Fibonacci Series

Leonardo Pisano Fibonacci (~1170-1250)

mouse over

A series of numbers in which each number is the sum of the two preceding numbers.

"0", 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765, 10946…

The route to a given cell is the sum of the routes to the two previous cells.

Fibonacci Series

Fibonacci Series	a/b	b/a
1	1	1
1	0.5	2
2	0.667	1.5
3	0.6	1.667
5	0.625	1.6
8	0.615	1.625
13	0.619	1.615
21	0.618	1.619
34	0.618	1.618
55	0.618	1.618
89	0.618	1.618
144	0.618	1.618
233	0.618	1.618
377	0.618	1.618
610	0.618	1.618
987	0.618	1.618
1597	0.618	1.618
2584	0.618	1.618
4181		

a/b = smaller/larger number

b/a = larger/smaller number

The Golden Section (Phi) is the limit of the ratio b/a.

Fibonacci Spiral and the Golden Rectangle

The sunflower

Leonardo's Mona Lisa

The End