Section 1.3: The Golden Ratio

Ancient Greek mathematicians were also philosophers & artists, & the aesthetic aspects of their work was important to them. A characteristic that makes many objects visually pleasing is their proportionality. A particular proportion that is seen in ancient & modern times & all over the world is the "golden proportion".

ex// Find the golden cut if AB is, say, 7cm

EXAMPLE 1: <u>CONSTRUCTING A GOLDEN CUT</u>

with ONLY ruler & compass, how can we find C given line segment AB?

$\boxed{\text{EXAMPLE 2}}$: CONSTRUCT A <u>GOLDEN</u> RECTANGLE

(with a given height)

The golden ratio appears in ancient art & architecture. It has also been said that people's perception of beauty of a human face is closely related to whether or not it fits nicely into a (vertical) golden rectangle.

$\boxed{\text{EXAMPLE 3}}$: CONSTRUCT A GOLDEN SPIRAL

Some Terminology:

Isosceles triangle:

Acute triangle:

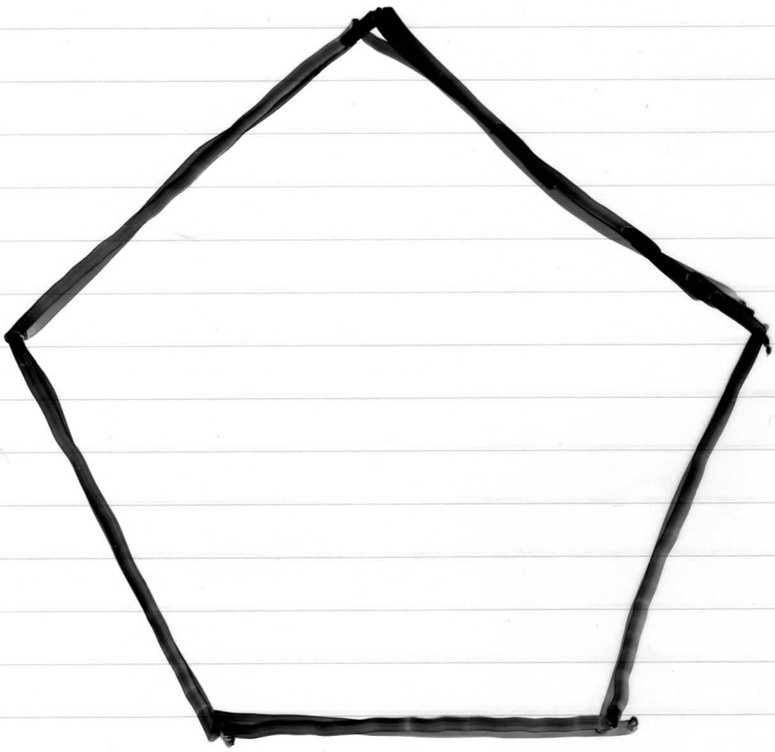
Obtuse triangle:

A "golden triangle" has the ratio of its long side over its short side = 1.618...

EXAMPLE 4: CONSTRUCT AN ACUTE GOLDEN TRIANGLE

We can subdivide an obtuse golden triangle into an acute & obtuse golden triangle.

Regular Pentagon :



$\boxed{\text{EXAMPLE 5}}$: CONSTRUCT A REGULAR PENTAGON

So in summary, we have seen 5 shapes made with the golden cut $\frac{1+\sqrt{5}}{2} \approx 1.618$

1. Golden rectangle
2. Golden spiral
3. Golden Acute Triangle
4. Golden Obtuse Triangle
5. Regular Pentagon

Section 1.4: Fibonacci Numbers

From the ancient Greeks we fast-forward to Italy in the middle ages, where a man named *Leonardo Pisano* posed this problem:

"A certain man put a pair of rabbits in a place surrounded on all sides by a wall. How many pairs of rabbits can be produced from that pair in a year if it is supposed that every month each pair begets a new pair which from the <u>second month on</u> becomes productive"

Leonardo lived in Bonacci, hence his moniker "Fibonacci" (son of Bonacci).

The increasing sequence of numbers of pairs of rabbits is the "Fibonacci Sequence" & the numbers in that sequence are "Fibonacci numbers"

This is not the most convenient formula.
What if we wanted f_{150}? Must start from f_1

ex// find f_{20} & f_{21} given $f_{19} = 4181$ & $f_{22} = 17711$

The Fibonacci #'s & the golden ratio
have a surprising & interesting relationship.

Seeds are distributed in a spiraling
pattern, one set clockwise, the
other counterclockwise.

Flower: how do they "araaonge" seeds?

- real flowers don't like angles of displacement that go evenly into 360°

? Why ?