Monday Week 6

1. Final Project
   a. Producible: open
      i. paper
      ii. website
      iii. poster
2. Today

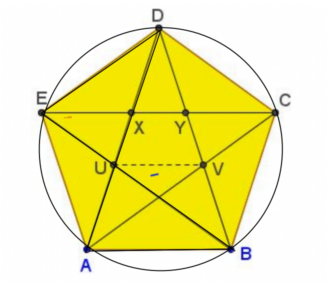
Exam 1 - Wed, Feb. 26

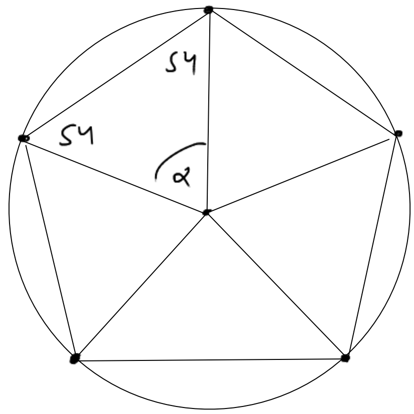
Ch. 3, Euclid + Number theory

$2\beta + 72 = 180$

$5\alpha = 360 = 2\pi$

$\alpha = \frac{2\pi}{5} = \frac{360}{5} = 72^\circ$





$\cos\left(\frac{2\pi}{5}\right) = 0.309$

$\cos\left(\frac{\pi}{5}\right) = \frac{1}{1.618}$

$\cos(36)$

Golden Ratio: $\frac{\text{Short}}{\text{Long}}$

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$$\frac{DE}{EX} = \frac{EX}{XY} = \frac{UV}{XY} = \frac{EY}{EX} = \frac{BE}{AE}$$

Number Theory in the Elements

1. Book VII - IX
2. Euclidean Algorithm
   a. Find the GCD of two numbers
   b. It shows the GCD of two relatively prime numbers is 1
3. VII.30: prime p, plab implies pla or plb
4. VII.31: any composite is divisible by some prime
5. IX.14: **PROPOSITION IX.14** If a number be the least that is measured by prime numbers, it will not be measured by any other prime number except those originally measuring it.
6. Towards infinitude:
   a. 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97, 101, 103, 107, 109, 113, 127, 131, 137, 139, 149, 151
      0   150
      i. the first 36, 25 of which are less than 100
   b. sparsity: between 10,000,001 and 10,000,100 there are only 2

VII.30 p, prime $\Rightarrow$ if $p|ab$ = "p evenly divides ab"

then $p|a$ or $p|b$

i.e., $p|q \Rightarrow q = pm$, $m \in \mathbb{N}$

Ex $63 = 7 \cdot 9$

$7|63 \Rightarrow 63 = 7 \cdot m \quad (m = 9)$

$7|343 \Rightarrow 343 = 49 \cdot 7 = 7^3$

Ex $3|60 \Rightarrow 60 = 10 \cdot 6$

thus $3|10$ or $3|6$

or $60 = 5 \cdot 12$

$3|60 \Rightarrow 3|5$ or $3|12$

Ex $4|60$ & $60 = 2 \cdot 30$

$4 \nmid 2$ and $4 \nmid 30$

$\Rightarrow$ p must be prime

Euclidean Algorithm $\Rightarrow a = qb + r$

Find GCD of two #'s.

375 , 276

$375 = 1 \cdot 276 + 99$

$276 = 2 \cdot 99 + 78$

$99 = 1 \cdot 78 + 21$

$78 = 3 \cdot 21 + 15$

$21 = 1 \cdot 15 + 6$

$15 = 2 \cdot 6 + 3$

$6 = 2 \cdot 3 + 0$

21 , 4

$21 = 5 \cdot 4 + 1$

$4 = 4 \cdot 1 + 0$

Goal: the "Great theorem of Ch. 3".

prime number: a number, greater than 1, is divisible by only 1 and itself.

List of Primes b/w 1 and 100

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, ...

Given the heavy concentration of primes near 0, does this mean we run out — $\exists$ only a finite # of primes? NO