The Classical Mathematicians
– And Beyond –

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Agriculture -
First Humans
to Americas

15,000 BC

Moscow Papyrus
1850 BC

Plimpton 322
1700 BC

1st Mathematician

Thales

600 BC

Plato

400 BC

Hippocrates

450 BC

Erastosthenes

250 BC

Pythagoras

550 BC

Eudoxus

400 BC

Euclid

300 BC

Archimedes

225 BC

Euler

1750

Newton

1650

Gauss

1800

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HW Hint #1

consider the # 10.

Ex1

$10 = 2 \cdot 5$

choose any factor of 10, (say 2) add it to 10!

$10 + 2 = 12$, the result will be composite.

$= 2 \cdot 5 + 2$

$= 2(5+1) \Rightarrow 2 \mid 12.$

Ex2

$99 = 3 \cdot 33$

add 33 to 99 = 132 must be composite (divisible by 33)

Ex3

$5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$

$5! + 3$ must be composite

$= 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 + 3 = 3(5 \cdot 4 \cdot 2 + 1)$

$3 \mid 5! + 3$

Is these # prime or composite

prime. (b/c 101 is prime)

$\boxed{}\ 100! + 101$ (e.g. $4! + 5 = 24 + 5$ prime

$2! + 3 = 5$

$\boxed{}\ 100! + 93$

composite

Different (Restricted) ways to write #'s

- Any #, is either a mult. of 2 (even) or not (odd)

  $n = 2k$ or $n = 2k+1$

- Any # has the form : eq, $345 = 3 \cdot 115$

  $3k$, or $3k+1$, or $3k+2$

- $4k+1$, $4k+3$ – any odd # can be written in one of the two forms

- HW Any # : $6k$, $6k+1$, $6k+2$, $6k+3$, $6k+4$, $6k+5$

  Some are prime candidates, some not

Pi Journey thru Genius

D=10

$C = \pi \cdot D \approx 30$

1. Egypt - Rhind Papyrus - (4/3)^4 = 3.160..
2. Bible: I Kings 7:23
   a. “Then He made the molten sea, ten cubits from brim to brim, while a line of 30 cubits measured it around.”
3. In the 2nd century CE, Ptolemy used the value $^{377}/_{120}$, the first known approximation accurate to three decimal places. It is equal to 3 + 8/60 + 30/60^2
   a. table of chords
4. Chinese: 150 CE
   a. The Chinese mathematician Liu Hui in 263 CE computed π to between 3.141024 and 3.142708 by inscribing a 96-gon and 192-gon;
5. Bhaskara (1110 CE) … pi = 3.1416
6. Simon Stevin (1500 CE) - decimal system, helped matters
7. Francois Viete: (1550 CE)
   a. used polygons with 393,216 sides … 9 decimal places.
   b. Ludolph van Ceulen (1600’s)
      i. 35 correct decimal places
      ii. after years of effort
      iii. polygon with 2^62 sides. (4 million trillion sides)
   c. Leibniz’s series: 1 - 1/3 + 1/5 - 1/7 + 1/9 - 1/11 + 1/13 - 1/15 + … approximates pi/4
      i. from geometry to arithmetic
      ii. approaches slowly
      iii. after 150 terms only get 3.1349
      iv. little practical use
   d. Shart (1650) 71 places, Machin (1680) 100 places
   e. Lambert (1750) pi is irrational, so no decimal is gonna get it.
8. Ramanujan (1887-1920)
   a. poor, self taught, failed out of school,
   b. was urged to write of his discoveries to England, one sent to G.H. Hardy (Cambridge) (1913)
   c. strange formulas, poor English … it haunted Hardy all day
      i. “the formulas must be true bc no one has the imagination to invent them.
   d. travel to England was hard due to religion, diet, but he arrived in Cambridge 1914.
   e. Highly accurate approximations to pi
   f. 1919, back to India in poor health.
   g. Story of Ramanujan on death bed
      i. The number 1729 is known as the Hardy–Ramanujan number after a famous visit by Hardy to see Ramanujan at a hospital. In Hardy's words:[76]

         > I remember once going to see him when he was ill at Putney. I had ridden in taxi cab number 1729 and remarked that the number seemed to me rather a dull one, and that I hoped it was not an unfavorable omen. "No", he replied, "it is a very interesting number; it is the smallest number expressible as the sum of two cubes in two different ways."

         Immediately before this anecdote, Hardy quoted Littlewood as saying, "Every positive integer was one of [Ramanujan's] personal friends."[77]

         The two different ways are:

         $$1729 = 1^3 + 12^3 = 9^3 + 10^3.$$
   h. Formula for pi

Perfect #: it is the sum of its proper divisors.

1, 6, 28, 120

1 + 2 + 3

1 + 2 + 4 + 7 + 14

$n = 1$

$1 + 2^1$

$2(1 + 2^1) = 6$

$n = 2$

$(1 + 2 + 2^2)$

$2^2(1 + 2 + 2^2) = 28$

Euclid: developed a formula (in 300 BC) to produce perfect numbers

start $1 + 2 + 2^2 + 2^3 + \dots + 2^n$

then multip's by 2^n

$2^n(1 + 2 + 2^2 + 2^3 + \dots + 2^n)$ – this produces a perfect

– Every even perfect # has this form