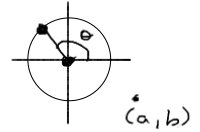


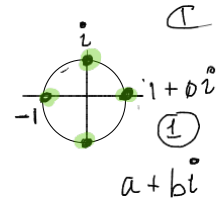
Leonhard Euler: 1707 - 1783

1. Switzerland, Russia, Berlin
- ▼ 2. math / physics / astronomy / geography / engineer
 - a. created graph theory & topology
 - b. analytic number theory, complex analysis, calculus
 - ▼ c. solidified the use of mathematical notation
 - i. function notation: $f(x)$
 - ii. greek letter: π
 - iii. imaginary number: i
 - iv. summation: Σ
 - v. defined the constant e
 - vi. introduced the use of exp function & logs in proofs
 - vii. Euler's formula: $\exp(iz) = \cos(z) + i\sin(z)$
 - viii. Pioneered analytic methods in number theory
 - ix. hyperbolic trig functions
 - x. continued fractions
 - d. mechanics / fluid dynamics / optics / astronomy / music theory
- ▼ 3. Truly one of the greatest mathematicians in history.
 - a. Laplace: "Read Euler, read Euler he is the master of us all."
 - b. Gauss: "The study of Euler's works will remain the best school for the different fields of mathematics, and nothing else can replace it."
 - ▼ c. Most prolific
 - i. 850+ publications
 - ii. 92 volumes
 - d. Graph Theory / Topology: Seven Bridges of Königsberg
 - ▼ e. Basel Problem:
 - i. What is the sum of reciprocals of squares?
 - ▼ ii. Named after the town of Basel, Switzerland
 1. hometown to Euler & the Bernoulli's
 - f. Topology: Euler Characteristic

$$(4,5) \quad \mathbb{R}^2$$



$$e^{i\theta} = \cos \theta + i \sin \theta$$



$$2, 2^2, 2^3, 2^4, \dots$$

$$i, i^2, i^3, i^4, i^5$$

$$(\sqrt{-1})(\sqrt{-1})$$

$$(-1)^{1/2} (-1)^{1/2} = (-1)$$

$$i^3 = i^2 \cdot i = (-1) \cdot i = -i$$

$$i^4 = i^3 \cdot i = (-i) \cdot i = -i^2 = -(-1) = 1$$

$$= -i^2$$

$$= -(-1) = 1$$

Euler

$$e^{i\pi} + 1 = 0$$

$$e \approx 2.718, \dots, i = \sqrt{-1}$$

$$0, 1, \pi$$

χ
2
2
2
2
2

Name of Solid	No. of Faces (F)	No. of Vertices (V)	No. of Edges (E)	Type of regular n -gon (polygon) at each face (n)	No. of faces at each vertex (k)	No. of degrees in each face angle	No. of deg. in ea. polyhedral angle
Tetrahedron	4	4	6				
Cube	6	8	12				
Octahedron	8	6	12				
Dodecahedron	12	20	30				
Icosahedron	20	12	30				

The Regular Solids¹

Tetrahedron



Cube



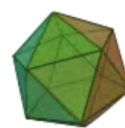
Octahedron



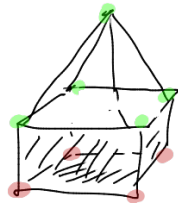
Dodecahedron



Icosahedron



$$\chi(\Sigma) = F - E + V$$



$$\chi = 9 - 16 + 9 = 2$$



Pyramid
sq Base

$$V = 5 +$$

$$E = 8 -$$

$$F = 5 +$$

$$\boxed{2}$$

Disk



$$\chi = 1$$

1 vertex

1 (rounded) edge

1 face

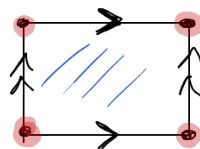
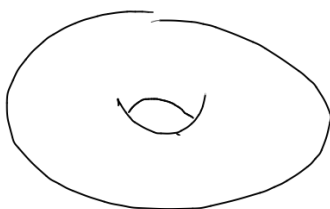
Circle



$$\chi = 0$$

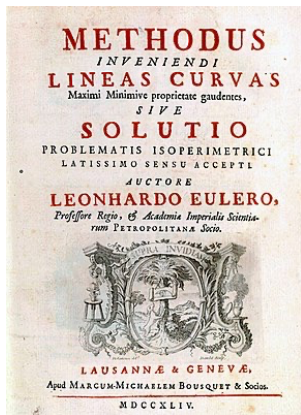
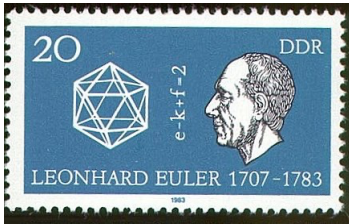
1 vertex
1 edge

Torus



$$\chi(\text{square}) = 4 - 4 + 1 = 1$$

$$\chi(\text{Torus}) = 1 - 2 + 1 = 0$$



Euler's life Timeline

1. Oldest of 4 children
2. At 13, began University of Basel
3. At 16, Masters of Philosophy: compared philosophies of Descartes & Newton
- ▼ 4. At 20, entered Paris Academy prize competition
 - ▼ a. What's the best way to place the masts on a ship?
 - i. Took 2nd place behind Pierre Bouguer - father of naval architecture
 - b. Euler entered this competition 15 times (winning 12)
- ▼ 5. At 20, worked Russian Academy of Sciences with Daniel Bernouilli (replacing Nicolaus)
 - a. Mastered Russian
 - b. Medic in Navy
 - c. Had long post at the Academy (physics, math)
- ▼ 6. 1734 (At 28) married Katharina Gsell
 - a. 13 children, only 5 survived childhood
- ▼ 7. 1741 (At 34) left Russia
 - a. Berlin Academy
- ▼ 8. 1748 (At 41) Text: Introductio in analysin infinitorum
 - a. Foundations of mathematical analysis
9. 1755 (At 48) Text: Differential Calculus
- ▼ 10. 1755 (At 48)
 - a. Member of Royal Swedish Academy of Sciences
 - b. French Academy of Sciences
- ▼ 11. Early 1760's
 - ▼ a. 200 letters that became
 - i. Letters of Euler on different Subjects in Natural Philosophy Addressed to a German Princess



ii.

iii. The popularity of these Letters testifies to Eulers teaching ability (a rarity)

- ▼ 12. 1773 (At 64) His wife died
 - a. 3 years later he married her half sister Salome Gsell.



What was Euler not?

▼1. ?

- a. He was not Voltaire.
- b. Euler was a simple, devoutly religious man who never questioned the existing social order or conventional beliefs
- c. He was not a skilled debater.