

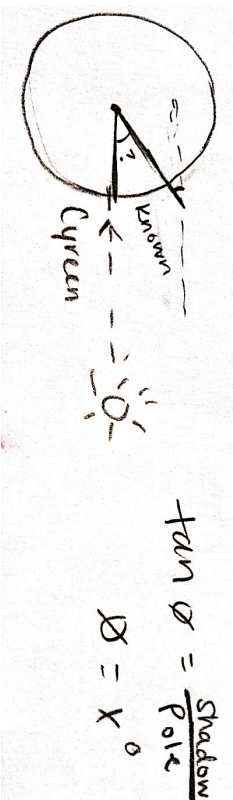
History of Geometry

Ancient Egypt	Greeks (Greco – Roman Republic)			
<i>a long time ago...</i>	900 B.C.	Thales 624-548 B.C.	Pythagoras 580-500 B.C	Socrates 469 -399 B.C.
<p>-“We owe geometry to the tax collector”</p> <p>-Empirical- concrete and practical</p> <p>-Based on reality and examples</p> <p>-No abstract (no exact values)</p> <p>- Knowledge was only for high Priestly class</p>	<p>- Knowledge is open to all</p> <p>- Abstract thinking</p> <p>→ Classify objects</p> <p>→Deductive reasoning/proofs</p> <p>→ Proofs about entire class of objects, prove infinite number of things with one proof</p> <p>- Relationships that matter, not how we apply those relationships to objects</p>	<p>Miletus Ionian School</p> <p>-Believed gods were false; all can be proved</p> <p>-First scientist/math.</p> <p>-Deductive reasoning</p> <p>-Studied Egyptians</p> <p>-5 theorems:</p> <ol style="list-style-type: none"> 1. A circle is bisected by a diameter 2. The base angles of an isosceles triangle are equal. 3. The pairs of vertical angles formed by two intersecting lines are equal. 4. Two triangles are congruent if they have two angles and the included side equal. 5. An angle inscribed in a semicircle is a right angle. <p><i>*Connect w/Aristotle: sensible world, knowledge in the concrete</i></p>	<p>Samos Pythagorean school</p> <p>- Privileged knowledge</p> <p>→ $a^2 + b^2 = c^2$</p> <p>- Proved Egyptian concrete thought</p> <p>- Secret knowledge until Hippasus told</p> <p>- Searched for perfection in proportions (<i>Golden Ratio</i>)</p> <p>→ <u>Axiomatic Method</u></p> <p>2 faults:</p> <ol style="list-style-type: none"> 1. Never ending chain of prior statements 2. Circular reasoning <p><u>Solution:</u> axioms and undefined terms</p> <p><i>*Connect w/ Plato: beauty and mind were locus of truth</i></p>	<p>-Socratic method</p> <p>→ Answer a question with a question</p> <p>-Died for corrupting minds of youth of Athens</p>

History of Geometry

<i>(Greco – Roman Republic, cont.)</i>				
Hippocrates 460-375 B.C.	Plato 427 – 348 B.C	Aristotle 384 – 322 B.C.	Euclid 365 – 280 B.C.	Archimedes 284 – 212 B.C.
<p>-Medical advances →Cures no longer dependent on religion →Believed natural causes which could be treated</p>	<p>Student of Socrates - Philosopher - Wrote about knowledge from Socrates “<i>Dialogues</i>” - Founder of The Academy – 1st university - Perfection is only reached in the mind - Author of <i>The Cave</i> - <i>The Cave</i>: The philosopher is the one who left the cave and tells the people of the outside world -Use mind to see beyond physical reality</p> <p><i>*Connect w/ Pythagoras: beauty and mind were locus of truth</i></p>	<p>Student of Plato - Philosopher - Reality was found in tangible objects, only through experience - Imperfection is in your mind, reality in in your senses - <i>The Cave</i>: didn’t agree, didn’t think that mind could produce concrete ideas beyond physical reality</p> <p><i>*Connect w/Thales: sensible world, knowledge in the concrete</i></p>	<p>- <i>Elements (13 vol)</i>: systematized geometry - 5 axioms and 5 postulates that all geometry can be based - Current methods of geometry</p> <p><u>Epicurus v. Proclus</u> - Epicurus – criticized Euclid’s work saying that it was common sense “even to a donkey”, do not need to prove - Proclus - defended Euclid by stating that we must “train our minds to think abstractly about reality, so that we can think about the unknown” (what cannot be perceived by the senses)</p> <p><i>* connect w/ Plato and Aristotle</i></p>	<p>- Inventor - Discovered things with great practical value → Lever and pulley → Engines of war → Water screw → Buoyancy</p>

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<i>(Greco, cont.)</i>	Romans		Dark Ages	Renaissance
Eratosthenes 274 - 194 B.C.	Caesar 49 B.C.	Christianity	476 - 1000 A.D.	
<p>- Director of Alexandria Library - Calculated the circumference of the earth</p>  <p>$\tan x = \frac{\text{Shadow}}{\text{Pole}}$</p>	<p>- Caesar won back Holy Land, renamed Roman Empire - Jesus/Christianity - Rome falls</p>	<p>- Greek understanding was that material things were imperfect - God became man: <i>Why would a perfect God want to become an imperfect man?</i> - The idea enters that there are things that are not concrete between God and humans (Gnosticism) - Brought back belief that beauty is in the mind</p>	<p>- Rome Falls - Rise and reign of Islam → Islam people find and restore the knowledge of the Greco-Roman culture → knowledge found in 2 libraries - M.C. Escher studies works in the libraries → Geometric art - Crusades - rediscover the libraries of knowledge - Knowledge was only preserved in the monasteries with the Catholic monks</p>	<p>- Logic of Aristotle reborn → Rules of how to think - Platonism reinforced - Universities were run by the Catholic Church, mixed theology and philosophy</p>

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Empiricism		Modern Times		
	Galileo Affair		David Hilbert 1862- 1943	Kurt Godel
<p>- Pythagoras and Plato thought → logic → consideration of beauty → senses are unreliable</p>	<p>- People were caught up in the concrete, didn't think for themselves - Took what Aristotle said as law, instead of thinking like him</p>	<p><u>Galileo Conflict</u> Rationalism: knowledge comes from reason, without senses</p> <p><u>Modern Conflict</u> Positivism: Knowledge is based on senses</p>	<p>- Taught Euclidean geometry at the Formalist school - Thought that all of geometry could be axiomized into 21 axioms (<i>opposed to Euclid's 5 / 5</i>)</p>	<p>- proves that completeness is virtually impossible 1. if consistent, then can't prove it 2. if not consistent, the can prove it is true and false at the same time - continuum hypothesis, axiom of choice</p>