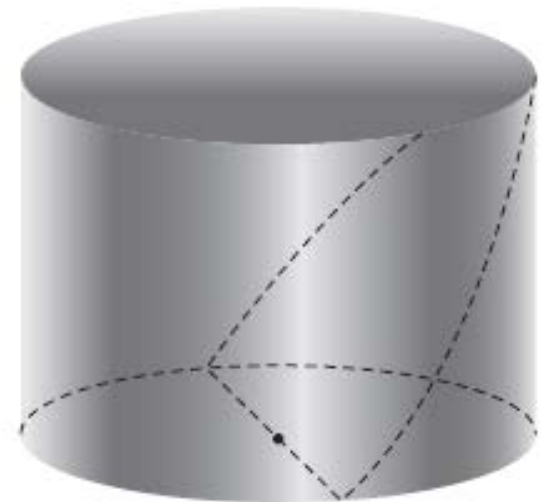
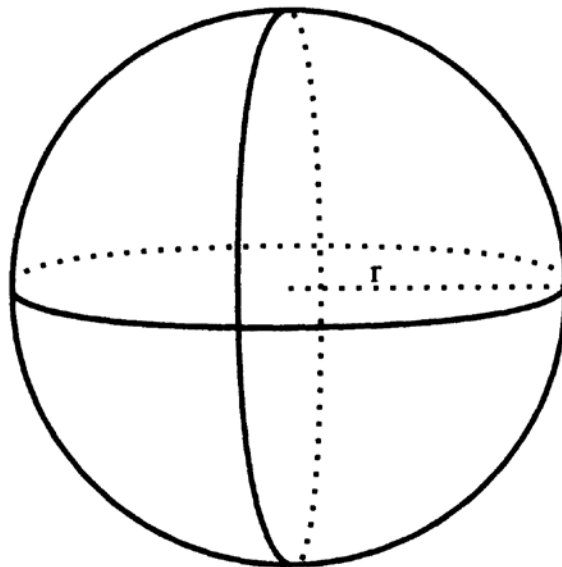
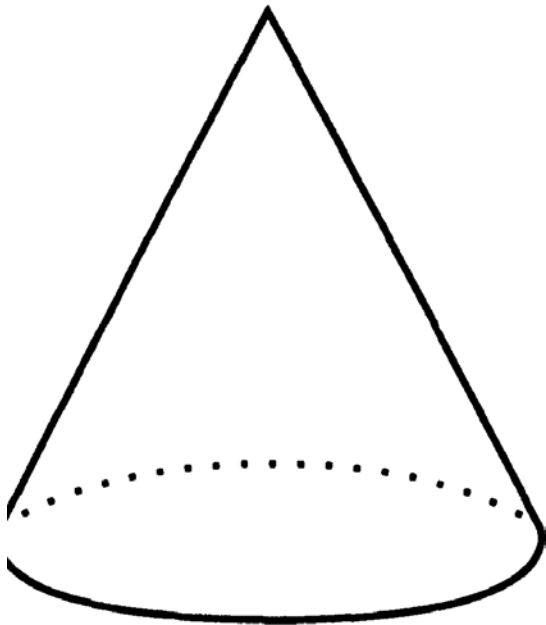


# Archimedes



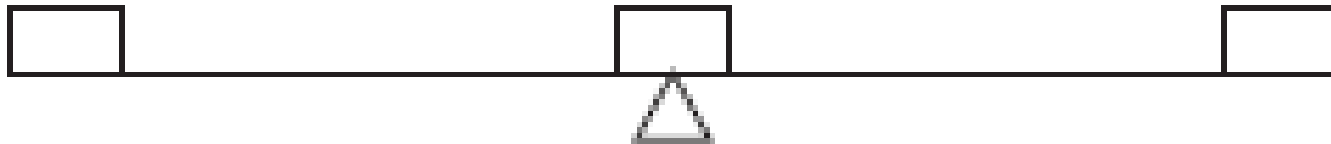
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# The war between Rome and Carthage

- Archimedes was born around 287 BCE and was killed by a Roman soldier around 212 BCE when Rome and Carthage were engaged in war.
  - His works span several disciplines, ranging from theoretical mathematics, physics, astronomy and even engineering of military weapons.
  - Various designs of catapults are attributed to him.
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# On the equilibrium of planes

- Archimedes wrote “On the equilibrium of planes” in which he derives the “law of the lever”.
- He tried to give mechanics an axiomatic treatment similar to Euclid’s Elements.
- The “law of the lever” is that two weights on a lever balance when they are inversely proportional to their distances from the fulcrum.



# The hydrostatic principle

- The discovery of this principle is connected to the famous story of Archimedes running naked through the streets of Syracuse shouting “Eureka” which means “I have found it.” when he discovered the principle of buoyancy.
- King Hiero wanted to know if the goldsmith cheated him of gold when he commissioned him to make a crown for him.



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# The problem is presented to Archimedes

- The problem is to determine if fraud was committed without destroying the crown.

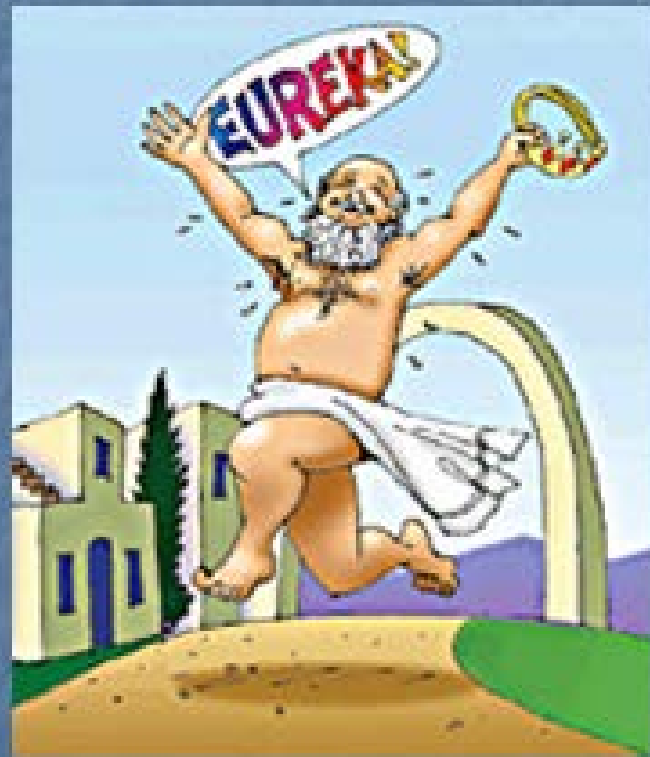


# Archimedes and his bath



- Archimedes goes to take a bath and notices water is displaced in proportion to his weight!

- He was so happy with his discovery that he forgot he was taking a bath!!



# The measurement of the circle

- Around 225 BCE, Archimedes wrote his famous treatise “The measurement of the circle” in which he derived the now famous formulas for the circumference and area of the circle of radius  $r$ , namely  $2\pi r$  and  $\pi r^2$  respectively.
- The ancients already knew the ratio of circumference of a circle to its diameter was a constant and that the ratio of the area to the square of the radius is constant. But they didn't know that these constants were the same!



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# The relation between the area and circumference of a circle

- If  $A$  is the area of a circle of radius  $r$  and  $C$  is its circumference, Archimedes proved that  $A = \frac{1}{2}rC$ .
  - He did this by using a proof by contradiction method, along with inscribing and circumscribing polygons in a circle.
  - Here is a summary of the method.
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# Inscribed and circumscribed polygons

- Step 1 is to inscribe regular n-gons in a circle and calculate the area.
- Step 2 is to circumscribe regular n-gons outside a circle and calculate the area.
- Step 3 is to take the limit as n tends to infinity.

