

Archimedes, Greek Mathematician and Engineer

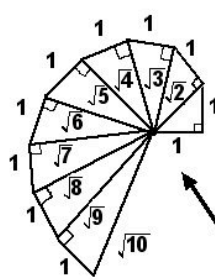
(Born Syracuse, Sicily c,287 BC, Died, Syracuse, c. 212 BC)

I have used as my resources for this, *Isaac Asimov's Biographical Encyclopedia of Science & Technology*, by Isaac Asimov and *God Created the Integers*, by Stephen Hawking.

Archimedes, was the greatest mathematician and scientist of ancient times, and along with Newton and Gauss, considered one of the top three mathematicians in history. Newton and Gauss arrived almost 2 000 years later, so this gives you an idea of how incredible this man was. The Roman General Marcellus wrote that Archimedes was killed at the end of the Second Punic War, in 212 BC. Apparently, he was working on Geometry in the sand when a Roman soldier found him. He refused to go with the soldier until he had finished his problem. Although there were orders to keep him alive, the soldier apparently killed him. At the time of his death he was about 75 years old.

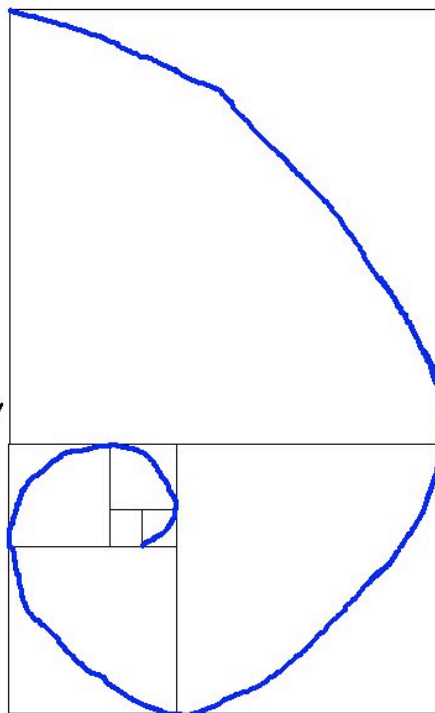
Some of the work of Archimedes is listed below:

- (1) Discovery of the principle of buoyancy. This discovery came, apparently, while in the bath, when he realized that the water that overflowed was equal to the volume of the portion of his body in water. At this time he was trying to figure out if a gold crown was pure gold. Realizing that he could find the volume of the crown by dipping it the water, and then he could compare it with the volume of an equal weight of gold. If the weights were the same, the crown was pure gold. So excited, he ran out of his bath and through the streets of Syracuse, completely naked, yelling "Eureka! Eureka!", which means "I've got it! I've got it!". Those of us who finally find the solution to a problem after much work, can feel his excitement. This principle of buoyancy is the reason why a large steel or cement ship can float.
- (2) Archimedes also discovered the principle of the lever. He showed that a small weight at a distance from a fulcrum can balance a larger weight near the fulcrum and that the weights and distances were in inverse proportions. Archimedes was said to have proclaimed, "Give me a place to stand on, and I can move the world!".
- (3) He is supposed to have invented a hollow, helical cylinder, that when rotated, pumped water. This "Archimedian Screw", has tremendous uses today. Take a close look at a screw.
- (4) The "Archimedian Spiral" is pictured below formed by two different methods.



Spiral made by attaching a side of 1 unit at right angles to each hypotenuse.

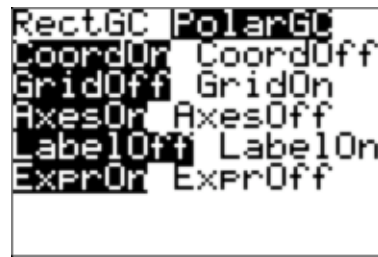
Spiral made by joining new vertex of next square forming adjacent rectangles each with sides in a golden ratio.



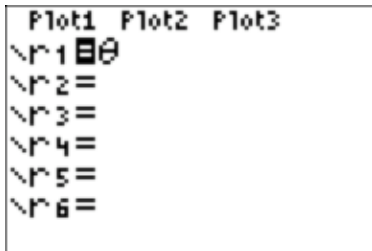
(5) Below is an Archimedian type spiral made from the graphing calculator in polar coordinates.



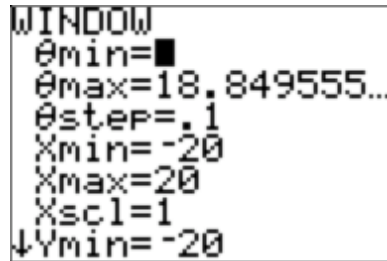
Set Mode to Polar



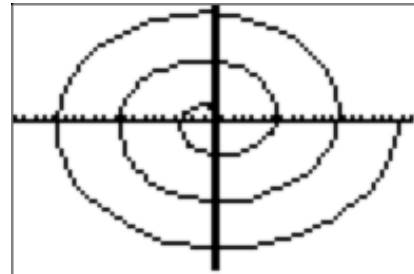
Set Format to Polar GC



Let $y = \theta$



Set Window θ Max = 6π X and Y Min and Max to ± 20 press Graph



(6) Archimedes also worked on the Area of a Circle and the value of Pi. He did this by inscribing and circumscribing polygons around a circle with more and more sides. His value of Pi was between

$3\frac{10}{71}$ and $3\frac{1}{7}$. This would put it at: $3.14084507 < \pi < 3.142857$. Since Pi is approximately

3.141592654, then you can see that this is pretty close. In addition, his concept of taking more and more sides, is similar to limits that are used in calculus. In fact, if they had had a better system of mathematical symbols to represent numbers, he may have stumbled upon calculus about 2 000 years earlier than Newton and Leibniz.

(7) The Romans sent a fleet against Syracuse and began a three-year siege of the Roman Fleet versus Archimedes. His ingenious war inventions apparently kept the Romans at bay for three years. Much of this is probably fiction, but stories were told of highly polished shields by 100's of soldiers formed a large lense to set fire to ships out in the harbour. (I saw a TV show, Mythbusters, where people tried this and it did not seem to work). Also, he apparently had large levers and cranes that reach over the walls and lift their ships out of the water! As you can see, if you tell 2 people and they tell 2 people, pretty soon the whole story gets overblown! However, there must be some things that are true, catapults and so on, in that the Roman General wanted Archimedes spared when the city finally capitulated.

This is a quick look at some of the legacy of this great Mathematician.