

The background features a dark blue gradient with a subtle pattern of white stars. On the left side, there are several overlapping circular elements. A prominent one is a large circle with a scale around its perimeter, marked with numbers from 140 to 260 in increments of 10. Other circles are smaller and some have dashed lines or arrows, suggesting a technical or scientific theme.

CHAPTER 8 SECTION 1

THE SCIENTIFIC REVOLUTION

I. Causes of the Scientific Revolution

A. During the Middle Ages, many educated Europeans took a great interest in the world around them.

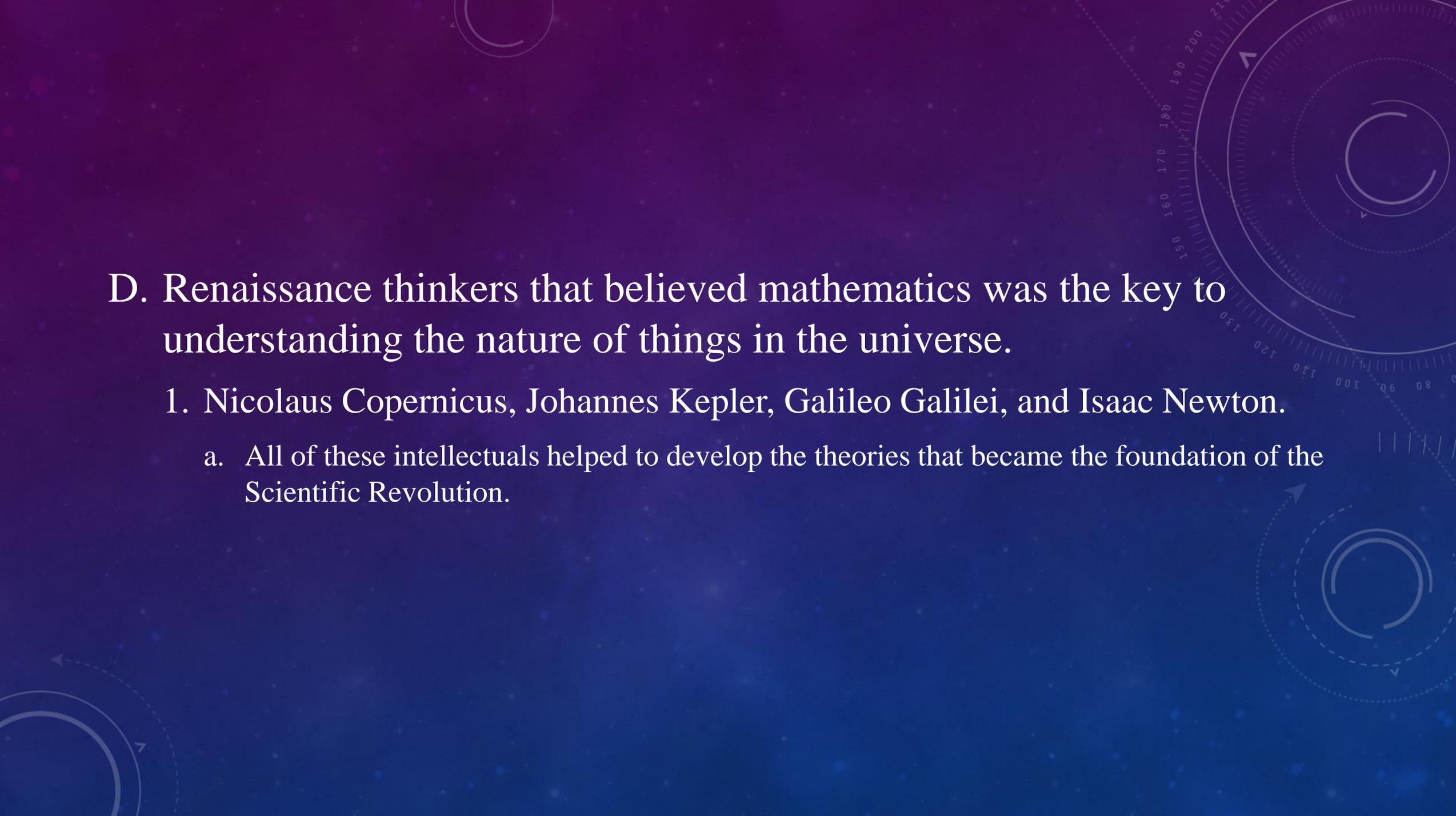
1. These “natural philosophers,” did not make observations of the natural world.
2. They relied on ancient authorities esp. Aristotle for their scientific knowledge.
 - a. During the 15th and 16th century natural philosophers began to abandon their old views.

B. Renaissance humanists had mastered Greek and Latin.

1. These languages gave them access to newly discovered work by Archimedes and Plato.
 - a. These works made it obvious that some of ancient thinkers had disagreed with Aristotle.

C. Other developments also encouraged new ways of thinking.

1. Technical problems that required careful observation and accurate measurements, such as calculating the amount of weight that ships could hold.
2. Invention of new scientific instruments, such as the telescope and microscope.
3. The invention of the printing press helped to spread new ideas quickly and easily.

The background features a dark blue gradient with a starry sky pattern. Overlaid on this are several faint, light blue geometric diagrams, including circles, arcs, and lines, some resembling technical or astronomical sketches. A prominent circular diagram in the upper right quadrant has concentric circles and radial lines, with numerical markings (150, 160, 170, 180, 190, 200, 210) along its outer edge. Other similar diagrams are scattered in the lower left and bottom right areas.

D. Renaissance thinkers that believed mathematics was the key to understanding the nature of things in the universe.

1. Nicolaus Copernicus, Johannes Kepler, Galileo Galilei, and Isaac Newton.

a. All of these intellectuals helped to develop the theories that became the foundation of the Scientific Revolution.

II. Scientific Breakthroughs

A. Ptolemy was the greatest astronomer of antiquity.

1. Ptolemaic System- This system is Geocentric because it places Earth at the center of the universe.

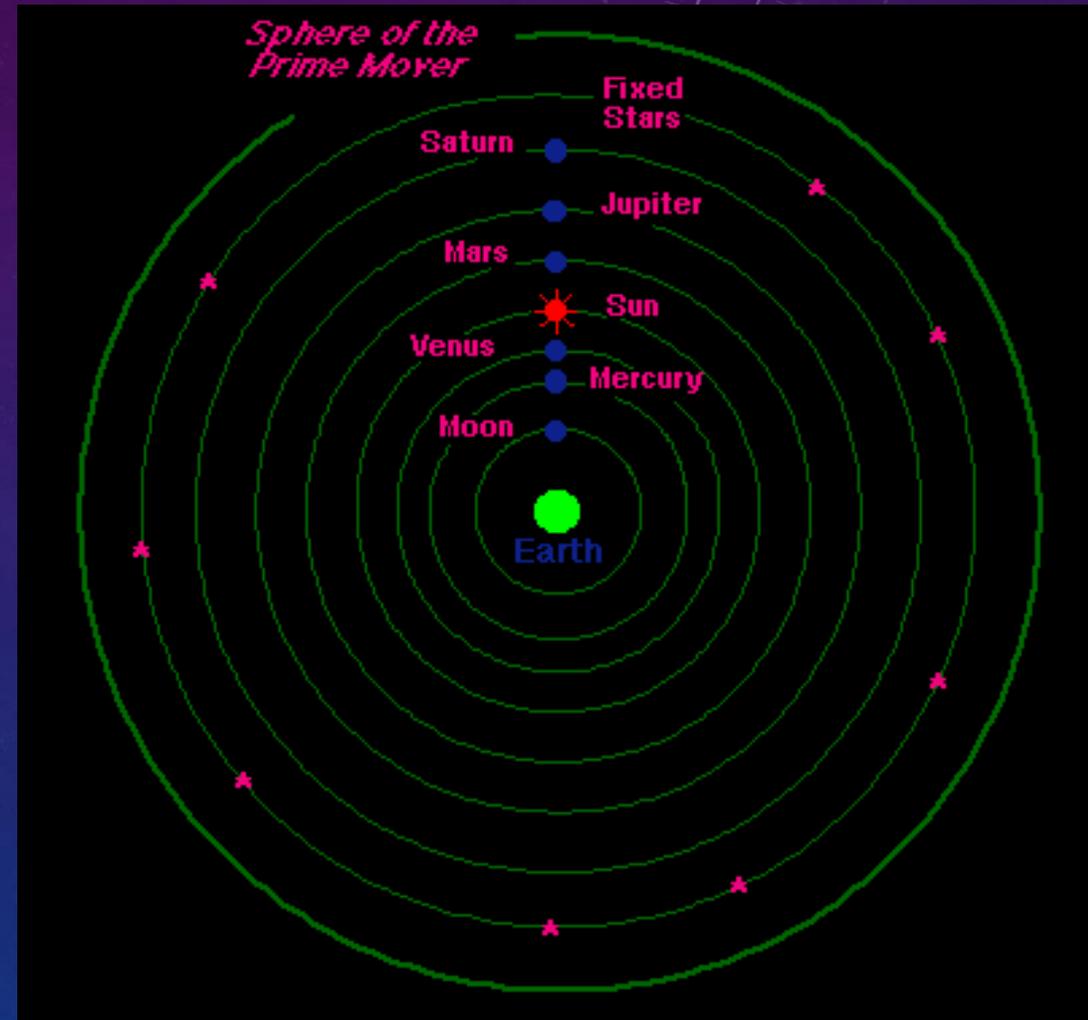
B. In his system, the universe is seen as a series of concentric spheres with the Earth fixed at the center.

1. The heavenly bodies are pure orbs of light that rotate around the earth.

C. The 10th sphere is the “prime mover.”

1. This sphere gives motion to the other spheres.

2. Beyond the 10th sphere is God and heaven.



D.1543, Nicolaus Copernicus published, *On the Revolution of the Heavenly Spheres*.

1. He believed that his Heliocentric, or sun-centered universe offered a more accurate explanation.
 - a. In his system, the sun, not the Earth, was at the center of the universe.
 - b. Copernicus theorized that the suns apparent movement around the Earth was caused by the rotation of the Earth on its axis.



E. Johannes Kepler, used detailed astronomical data to arrive at his laws of planetary motion.

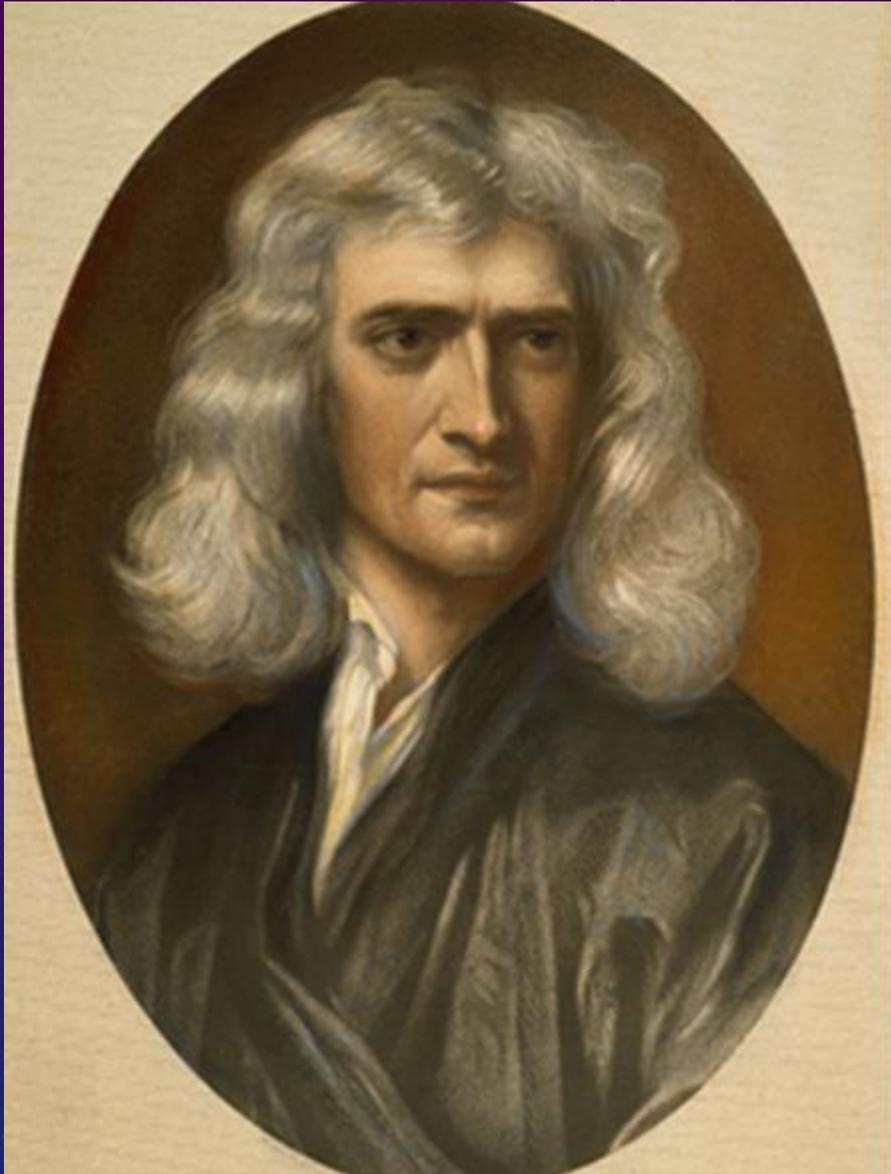
1. Kepler showed that the planets' orbits around the sun were not circular, as Copernicus had thought. Rather, the orbits were elliptical (egg-shaped), with the sun toward the end of the ellipse instead of at the center.
 - a. This contradicted the circular orbits and crystal-like spheres that were central to the Ptolemaic system.

F. Galileo used a telescope to make a series of remarkable discoveries: mountains on the Earth's moon, four moons revolving around Jupiter, and sunspots.

1. Galileo's observations destroyed the belief that the Heavenly bodies were pure orbs of light. They appeared to be composed of material substance just like earth.
2. Galileo found himself under suspicion by the Catholic Church.
 - a. The church ordered him to abandon the Copernican idea of the universe.
 - b. In spite of the Church's position most astronomers had accepted the heliocentric universe.



Galileo appears before officials in the Vatican in 1663.



G. Isaac Newton was a professor of mathematics at Cambridge University.

1. In his book *Principia*, Newton defined his three laws of motion.
2. Universal law of gravitation- every object in the universe is attracted to every other object by a force called gravity.
 - a. This one universal law, could explain all motion in the universe.
 - i. Newton's law will dominate the worldview until Albert Einstein's theory of Relativity.

H. Galen, a Greek physician, dominated medicine in the Late Middle Ages.

1. Relying on animal, rather than human, dissection to picture human anatomy, Galen was wrong in many instances.

I. Andreas Vesalius and William Harvey added to the understanding of human anatomy.

1. Vesalius, a professor at the University of Padua accurately described the individual organs and general structure of the human body.
2. William Harvey showed that the heart—not the liver, was the beginning point for the circulation of blood.
 - a. He also proved that the same blood flows through the veins and arteries and makes a complete circuit through the body.

J. Margaret Cavendish wrote a number of works on scientific matters, including *Observations Upon Experimental Philosophy*.

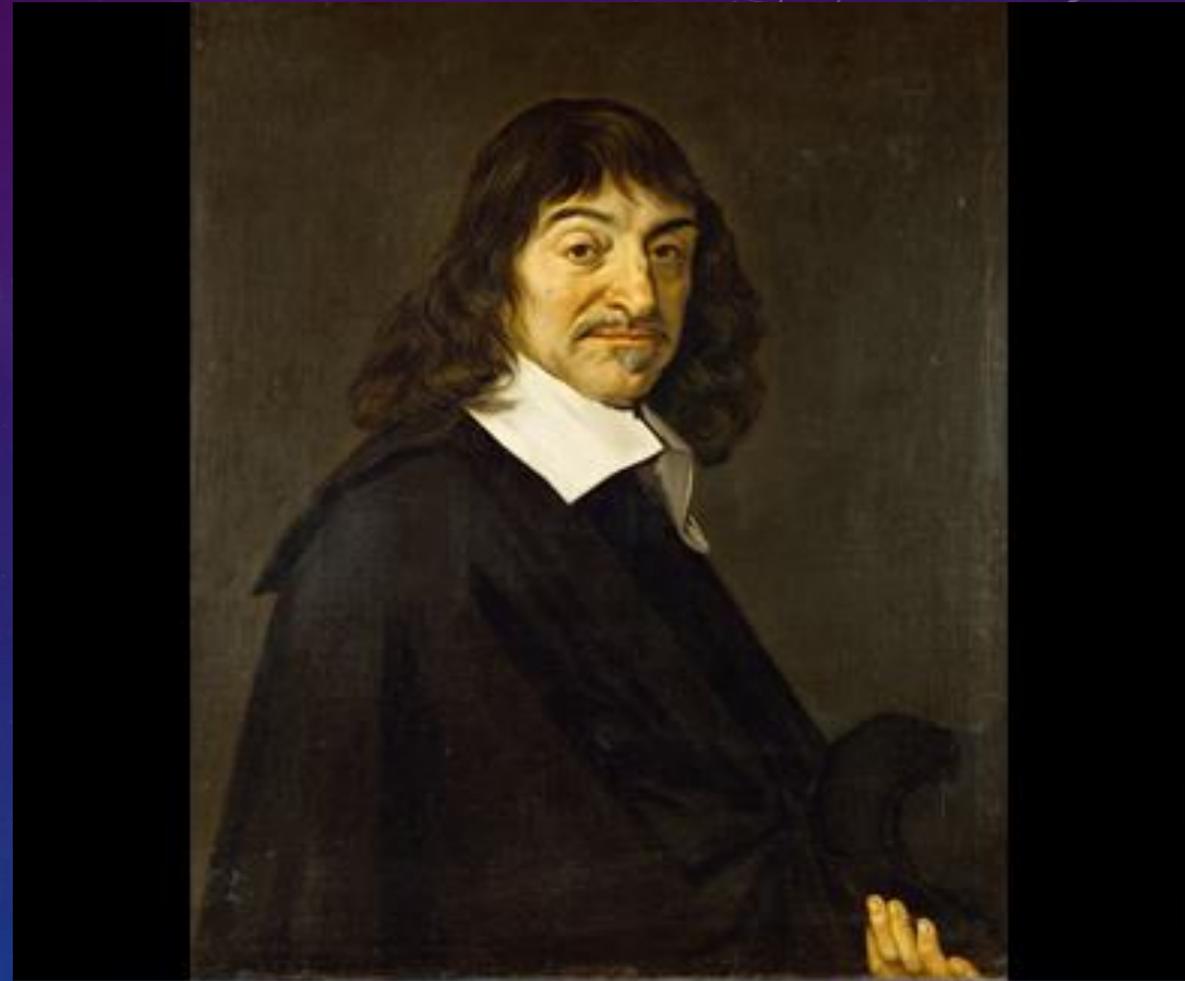
1. In this work, Cavendish was critical of the belief that humans, through science, were the masters of nature.

K. Maria Winkelmann was a self-taught astronomer that discovered a comet.

1. When her husband died, she applied for his position at the Berlin Academy.
 - a. She was denied the job since members of the academy feared that they would set a bad example by hiring a woman.

III. Philosophy and Reason

- A. Renè Descartes was a philosopher who asserted that he can only be sure of one thing— his own existence.
1. “I think, therefore I am”
 2. Father of modern rationalism or the belief that reason is the chief source of knowledge.



René Descartes (1596–1650)

B. Francis Bacon, who developed the scientific method was not a scientist, but an English philosopher.

1. Used inductive reasoning- proceeding from the particular to the general.

**Deductive
vs Inductive
Reasoning**



The Scientific Method

