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René Descartes

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Abstract:

René Descartes is a mathematician, philosopher, scientist, and Christian, who made a profound impact on the world of mathematics and science. Descartes is known as the founder of analytical geometry. He was born in France in 1596. Descartes was raised by his grandmother until he went to Jesuit college of Le Fléche. Le Fléche was where Descartes was first exposed to mathematics and philosophy. After university, Descartes met Isaac Beeckman in 1618, while serving in the military. Isaac Beeckman was the main motivator for Descartes' pursuit in mathematics. Descartes studied under Beeckman briefly. While corresponding with Beeckman, Descartes revealed the foundations of analytical geometry through his discovery that algebraic equations can be solved using a proportional compass and geometric shapes. In 1637, his only mathematical publication, *Geometry,* was published. *Geometry* was one of Descartes most important works ever published. The ideas in *Geometry* fueled research and insight in physics and philosophy and even contributed to Descartes' proofs of God's existence. The details of Descartes' strong belief in God as the reason for everything are explained in his work, *Meditations*. Descartes' proof of the existence of God guided all of his work. It was through his attempt to prove the existence of God that Descartes discovered his mathematical contributions and made his contributions to the development of Cartesian mathematics. Without his strong faith, René Descartes would not have been able to impact the world of mathematics and science so profoundly.

René Descartes:

René Descartes was born on March 31, 1596, in La Haye en Touraine, France. La Haye en Touraine is now called Descartes. Descartes was the son of Joachim Descartes, whom was a Councillor at the Parliament of Brittany, and Jeanne Brochard. Joachim Descartes left René and his siblings, Pierre and Jeanne, in the care of their grandmother, Jeanne Sain, after their mother passed away. Descartes' mother passed away on May 13, 1597. Despite his father remarrying and his siblings moving in with his father and stepmother, René remained in the care of Jeanne Sain until he entered the Jesuit college of La Fléche in 1606 (Gaukroger, 20).

Jesuit schools were run by a group of Roman Catholics that aimed to better humankind's spiritual growth through education. The first five years of study focused on rhetoric. A majority of students left the school after the first five years to either go out into society or go on to higher education. However, René Descartes was not most students. He chose to continue his education at the Jesuit college of La Fléche for an additional three years. During his additional three years, Descartes studied mathematics and philosophy. The philosophy studied was Aristotelian philosophy, while the mathematics studied was Euclidean geometry (Gaukroger, 52-53). Descartes gained an abundance of knowledge through his studies in mathematics and philosophy at La Fléche. Though, it would not be until years later that he truly pursued mathematics.

After La Fléche, Descartes attended University of Poitiers and earned his baccalaureate and license in civil and canon law in 1616. While his father pressured him to continue in law, Descartes refused and enlisted in the army at age 21. Though he never saw any military action, Descartes met one of the most influential people on his mathematical discoveries through his stationing in Breda. Meeting Isaac Beeckman in 1618 challenged Descartes to once again consider mathematical problems. Beeckman became like a mentor to Descartes and pushed him to renew his study of mathematics. Descartes and Beeckman spent only a short time together in person, but corresponded by letters until the early 1620s. In Descartes' March 26, 1619, letter to

Beeckman he reveals his mathematical inquiries for the first time. Descartes stated that he had "'found four extraordinary and completely new demonstrations by means of {his} compass,'" (Gaukroger, 92-93). The first discovery addressed the issue of splitting an angle into as many sections as one desires, which was originally the question of trisecting the angle (Pappus Problem). "The other three relate to three classes of cubic equation: the first class having the whole number, roots, and cubes [$x^3 = \pm a \pm bx$]; the second a whole number, squares, and cubes [$x^3 = \pm a \pm bx^2$]; the third a whole number, roots, squares, and cubes [$x^3 = \pm a \pm bx \pm cx^2$]" … "each of which must cover the variable terms because of changes in + and – signs," (Gaukroger, 93). These four discoveries were the beginning of a new science that Descartes hoped would "answer every question that can be put about any kind of quantity whatsoever, whether continuous or discontinuous, each according to its nature," (Gaukroger, 93). This work was just the beginning of Descartes' mathematical contributions.

One of the major mathematical discoveries made by Descartes was his work with proportional compasses. Descartes' compass methods were very peculiar. He combined his knowledge of geometry with an algebraic foundation, while using many different forms of proportional compasses. Descartes was using geometric shapes to explain algebra. The beginning of analytical geometry became a reality when Descartes realized he could represent the variables and unknowns of algebraic equations with his compass. This discovery led him on a quest to break away from Aristotelian philosophy and create a new method that used mathematics to explore science, such as physics and astronomy.

René Descartes published his mathematical proofs and discoveries in *La Géometrie* (known as *Geometry* in English). *Geometry* was the third and final essay in Descartes' *Discours de la Methode* (known as *Discourse on the Method* in English). The *Discourse on the Method* was published in 1637 in Leiden. While *Geometry* was the only mathematical work that

Descartes published, it arguably was Descartes' most important publication because of the implications that it had on physics and our understanding of the universe (Warusfel, 1). Without Descartes' mathematical discoveries in *Geometry*, "the mathematization of the physics and the development of the calculus might not have happened when they did," (Smith). An example of how Descartes' mathematical discoveries impacted physics and our understanding of the universe is in the development of "a new conception of matter" and the development of Cartesian physics and mathematics (Smith).

Geometry is broken up into two books. In Book One, Descartes explains his geometrical interpretation of the five basic arithmetical operations (addition, subtraction, multiplication, division, and root extraction). The big arithmetical operation explained by Descartes' geometrical analysis was root extraction. Descartes' uses his geometrical analysis to address the Pappus problem, which gave rise to the birth of analytical geometry. The Pappus problem is the trisection of an angle. In Book Two, Descartes strengthens the links between geometry and algebra by explaining how geometric curves can be represented by an algebraic equation. Descartes classified his geometric curves in line with the degree of their algebraic equation (Domski).

Descartes provided the world with a wealth of knowledge through *Geometry*. The major mathematical contributions that came because of Descartes were analytical geometry, the Cartesian coordinate system, the idea of representing unknowns in algebraic equations with x, y, and z, and his insight into geometric calculus. Descartes' geometric calculus was used by Newton in the development of modern calculus. Descartes also influenced many philosophers and scientists. Descartes' mathematical discoveries played a big role in physics, which allowed Descartes to incorporate his religion into his work.

Descartes never denied or tried to hide his belief in God. Descartes used his belief in God as the beginning of all his discoveries. In his *Discourse on the Method*, "Descartes makes clear…

that his starting point for his science and his physics is the existence of God. It is from the existence of God as stable and unchanging that [Descartes] claims to be able to deduce, and thereby demonstrate, the basic laws of physics," (Wilson). The most profound work that encompassed and made Descartes' religious beliefs clear was *Meditations*, which was published in 1641.

In *Meditations*, "Descartes adapted the literary form of the spiritual exercise to his own philosophical purposes," (Hatfield, xiv). Descartes mastered the form of spiritual exercise during his time at the Jesuit college. Descartes was a devout Catholic, who "understood metaphysics to ground all other knowledge, of the self, of God, and of the natural world," (Hatfield, 3). Through the adaptation of the form of spiritual exercise Descartes' cognitive exercises called for one to strive for intellectual achievement through the affirmation of distinct metaphysical propositions. In *Meditations*, Descartes attempts to prove God's existence philosophically. Descartes hoped that if he could prove God's existence through philosophy, then he could convince non-believers that God exists. Since Descartes believed that everything must be created from something, he used this idea to help shape his proofs of God's existence. To further explain, "Descartes' proofs rely on the belief that by existing, and being born an imperfect being" with a soul, "one must, therefore, accept that something of more formal reality than ourselves must have created us," (Borghini). Descartes argued that since people are not born from nothing and are imperfect with a soul, then a higher power (God) must exist to create people.

Descartes used six meditations in his work, *Meditations*. In the first meditation, Descartes explains how he can doubt almost everything in the material world, which is where Descartes' explains his cognitive exercises. Descartes first argues that God is good and acknowledges a powerful evil that is out to deceive people, which highlights the need for the cognitive exercises. The cognitive exercises were designed to help one avoid falling for false truths. In the second

meditation, Descartes reveals his famous saying, "'I think, therefore I am,'" (Wilson). Descartes inferred that the mind and body are separate, which meant that thinking is a substance and separate from his body. It is here that Descartes argues that humans are not rational animals like Aristotle had argued. In the third meditation, Descartes addresses how humans are imperfect beings. Descartes argues that as imperfect beings, humans are lacking "something, the presence of which would be… God," (Wilson). In the fourth meditation, Descartes explains that God gave people free will. Free will is the reason that humans are not perfect. Descartes argued that "God's will does not cause use to error, it is our own will that does that, so the idea of a perfect God creating us is compatible with our being beings that fall into error," (Wilson). In the fifth and sixth meditations, Descartes argues the existence of God as a perfect being and the creator of people's ideas. Descartes argues that his ideas do not come from within himself, but rather they come from God. In the conclusion, Descartes provides evidence into "the essence of God," (Wilson). These six meditations were crafted through the analytical method.

However, prior to the publication of *Meditations*, Descartes had sent a copy of the manuscript to a hand full of other philosophers. Descartes received many objections to his work in *Meditations*. One of the major objections was that Descartes had used the analytical method to explain his thoughts, rather than using the synthetic method, combining analytical and geometrical methods together, he outlined in *Discourse on the Methods*. In response to this major objection, Descartes gave a "synthetically organized presentation of his inferences" in *Meditations* (Wilson).

Through his argument of the existence of God, Descartes applied his rules and mathematical discoveries to explain how God is the reason physics and philosophy exist. Descartes may not have proved the existence of God, but through his work and proofs of God's existence he gave rise to important aspects of modern science today. In *Discourse on the*

Methods and *Geometry*, Descartes introduces the idea of skepticism needed by all scientists when studying the world, as well as the idea of breaking problems down into their parts to solve them. Descartes' desire to prove that God exists through his methods and mathematical discoveries profoundly influenced calculus and physics. Through *Discourse on the Methods* and *Meditations*, Descartes used his faith to drive his work. Without Descartes' belief in God as the reason for everything, he may not have discovered the proof to the Pappus problem, which would have postponed the birth of analytical geometry, the development of mathematical physics, and the development of Cartesian mathematics. René Descartes made profound contributions to not only mathematics, but to physics and philosophy. He gave birth to analytical geometry, which helped him establish his research in metaphysics. However, without his strong religious beliefs and desire to prove God's existence with his rules and mathematics, Descartes would not have discovered the mathematics he did, nor would he have impacted the scientific method and our view of modern science so profoundly.

Personal:

I was born and raised in the Catholic Church, just like Descartes. I constantly continue to work and grow in my faith. My faith is a very crucial part of my life. I strive to represent God in everything I do. As a mathematician and psychologist, I want to be able to combine my faith with my research. I am hoping to one day make a difference in the world and find better ways for children with intellectual disabilities to integrate into society. God has blessed me with a heart for children, especially those with disabilities. I hope to be able to show God's love through my research with individuals with intellectual disabilities. One way I plan to accomplish this is by treating my participants and clients with the unconditional love that God shows us. I think showing love to others is how I exemplify Christ in my work life. At home, I am more open about my faith. I go to church every Sunday with my family and fiancé, as well as pray and

spend quiet time with God. Spending time studying the Bible is very important to my faith at home. I hope to be able to continue to exemplify Christ through showing other God's love and learning more about what a Christlike life looks like through studying my Bible.

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