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Cartesian Coordinates**Reading 1**

A little history on Rene Descartes – without whom – we may not be doing Coordinate Geometry!



Descartes was born in La Haye en Touraine, Indre-et-Loire, France (renamed "La Haye-Descartes" in 1802 and simply "Descartes" in 1967). At the age of eight, he entered the Jesuit College Royal Henry-Le-Grand at La Flèche. After graduation, he studied at the University of Poitiers, graduating with a *Baccalauréat* and *Licence* in law in 1616.

Significance

Often regarded as the first "modern" thinker for providing a philosophical framework for the natural sciences as these began to develop, Descartes in his *Meditations on First Philosophy* attempts to arrive at a fundamental set of principles that one can know as true without any doubt. To achieve this, he employs a method called Methodological Skepticism: he doubts any idea that can be doubted.

He gives the example of dreaming: in a dream, one's senses perceive things that seem real, but do not actually exist. (This idea is similar to what Chuang Tzu writes after dreaming that he is a butterfly.) Thus, one cannot rely on the data of the senses as necessarily true. Or, perhaps an "evil genius" exists: a supremely powerful and cunning being who sets out to try to deceive Descartes from knowing the true nature of reality. Given these possibilities, what can one know for certain?

Initially, Descartes arrives at only a single principle: if I am being deceived, then surely "I" must exist. Most famously, this is known as *cogito ergo sum*, ("I think, therefore I am"). (These words do not appear in the *Meditations*, although he had written them in his earlier work *Discourse on Method*).

Therefore, Descartes concludes that he can be certain that he exists. But in what form? You perceive your body through the use of the senses; however, these have previously proved unreliable. So Descartes concludes that at this point, he can only say that he is a *thinking thing*. Thinking is his essence as it is the only thing about him that cannot be doubted.

To further demonstrate the limitations of the senses, Descartes proceeds with what is known as the *Wax Argument*. He considers a piece of wax: his senses inform him that it has certain characteristics, such as shape, texture, size, color, smell, and so forth. However, when he brings the wax towards a flame, these characteristics change completely. However, it seems that it is still the same thing: it is still a piece of wax, even though the data of the senses inform him that all of its characteristics are different. Therefore, in order to properly grasp the nature of the wax, he cannot use the senses: he must use his mind. Descartes concludes:

"Thus what I thought I had seen with my eyes, I actually grasped solely with the faculty of judgment, which is in my mind."

In this manner, Descartes proceeds to construct a system of knowledge, discarding perception as unreliable and instead admitting only deduction as a method. Halfway through the *Meditations*, he



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also claims to prove the existence of a benevolent God, who, being benevolent, has provided him with a working mind and sensory system, and who cannot desire to deceive him, and thus, finally, he establishes the possibility of acquiring knowledge about the world based on deduction *and* perception. Mathematicians consider Descartes of the utmost importance for his discovery of analytic geometry. Up to Descartes's times, geometry, dealing with lines and shapes, and algebra, dealing with numbers, appeared as completely different subsets of mathematics. Descartes showed how to translate many problems in geometry into problems in algebra, by using a coordinate system – the Cartesian coordinate system named after him, to describe the problem.

The idea of this coordinate system was developed in 1637 in two writings by Descartes. In *Discourse on Method*, in part two, he introduces the new idea of specifying the position of a point or object on a surface, using two intersecting axes as measuring guides. In *La Géométrie*, he further explores the above-mentioned concepts.

The story has it that the Cartesian coordinate system was developed by Descartes during an illness. As he lay in bed sick, he saw a fly buzzing around on the ceiling, which was made of square tiles. As he watched he realized that he could describe the position of the fly by the ceiling tile he was on. After this experience he developed the coordinate plane to make it easier to describe the position of objects. Descartes was the first to make a graph, allowing a geometric interpretation of a mathematical function and giving his name to Cartesian coordinates.

Descartes's theory provided the basis for the calculus of Newton and Leibniz, and thus for much of modern mathematics. This appears even more astounding when one keeps in mind that the work was just meant as an *example* to his *Discours de la méthode pour bien conduire sa raison, et chercher la vérité dans les sciences* (*Discourse on the Method to Rightly Conduct the Reason and Search for the Truth in Sciences*, known better under the shortened title *Discours de la méthode*).

Reflections

Interested to find out more about Descartes's work? Go on line and you would have loads of information...

What strikes you as read this little snippet about the great mathematician Descartes? Awed? Inspired? Or...

My quote to you...what else but ...

cogito ergo sum, i.e. I think, therefore I am.