Cartesian Coordinate Encyclopedia Article

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The link between Euclidean geometry and arithmetic is achieved in the Cartesian coordinate system. The discoverer of this system, René Descartes, imagined points in space to be much like a fly hovering about in a room. The position of the fly can be determined by noting its unique distance from the walls, floor and ceiling. Just as the position of a fly can be determined with reference to three intersecting planes in a room, an abstract point in Euclidean geometry can be assigned an "address," or coordinate-position, using three numbers. The three numbers can be found to lie along intersecting lines juxtaposed at right angles to each other to form three axes, given by Descartes the conventional names *x*, *y*, and *z*, and denoting, respectively, horizontal, vertical, and lateral position.

The place where the axes intersect is called the origin. The abstract space generated by the x, y, and z axes is called the Cartesian coordinate system or grid. Using this scheme, geometric forms such as the line can be generated using numbers. If a line is composed of a series of points, then each point on the line must have a unique address or position on a Cartesian grid. Each point has an x, y, and z coordinate which is unique to that point. For example, a line drawn diagonally on a piece of paper can be described as having x and y coordinates on a two-dimensional Cartesian grid. If the address of each point of the diagonal line is such that the x value is the same as the y value, the line will extend from the origin at an angle of 45 degrees with respect to the x and y axis. A simpler way of stating this property is to say that the line is generated by the equation y=x. Thus, this mathematical equation has a corresponding "shape" in the geometric world. In fact, any equation can be graphed in this way. Conversely, any shape can be analyzed to determine what unique equation, or equations, can generate it, which is extremely helpful to mathematicians using calculus to determine the properties of forces and complex motions.