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Analytic Geometry of Three Dimensions

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Abstract—Analytic geometry can be defined as a branch of mathematics that is concerned with carrying out geometric investigations using various algebraic procedures (Mark, H., & Workman, J. (2007). This paper seeks to discuss about analytical geometry of thee dimension and it will start by introducing the subject matter as well as giving a brief history on analytical geometry. The paper also gives different examples of analytical geometry of thee dimensions and how they can be used to solve various different problems

1 Introduction

Analytical geometry was originally formulated in order to be able to make effectively investigations on plane geometry but the concept of analytical geometry can also be used to explore other spaces of higher dimensions (Mark, H., & Workman, J. (2007). While analytical geometry is concerned with the study involving conic sections, analytic geometry of three dimensions also referred to as solid analytic geometry is interested with the study involving quadric surfaces. Analytical geometry of thee dimension usually makes good use of the coordinate system (Mark, H., & Workman, J. (2007). A coordinate system is a scenario where real numbers in triples (a,b,c) are considered and it is the set of these real numbers in tipple that are referred to as the three dimensional number space. An analytical geometry of thee dimension is usually denoted by the symbol R3 where each of every individual tipple represents a point in the R3 symbol. The three elements that are represented in each of the three triples are what are referred to as the coordinates of the three dimensional number space (Mark, H., & Workman, J. (2007). This coordinates helps us or makes it easy for mathematicians to be able to plot a three dimensional figure.

Analytic geometry ensures that positions of specific points are made specified coordinates in order for geometrical relationships between the specific points to be equivalent to the algebraic relationships that exists between their coordinates (Protter, M. H., & Morrey, C. B. (1985). This correspondence existing between geometry and algebra makes it possible to be able to prove the propositions involving geometric relationships using algebraic calculations (Protter, M. H., & Morrey, C. B. (1985). The use of these algebraic techniques has often proved to be very effective.

2 History of Analytical Geometry

Menaechmus, a Greek mathematician used to solve problems as well as develop and prove theorems by employing a method that strongly resembled coordinated and it is widely believed that the initial idea behind analytical geometry originated from him (Lutz, P. L. (992). French mathematician and philosopher, Rene Descartes is generally credited for the invention of the ideology behind analytical geometry (Lutz, P. L. (992). In his article, Discours de la methode (1637) Descartes outlined the principles behind analytical geometry. Another mathematician and philosopher, Pierre de Fermat had also written various different principles of analytic geometry but his worked had to wait to be published until 1679 (Lutz, P. L. (992). The existing ideology behind analytical geometry was developed by Leonhard Euler who borrowed heavily from Pierre de Fermat and Rene Descartes earlier ideas and combined them to come up with a more reasonable and concrete understanding of the current analytical geometry (Pedoe, D. (1988).

The emergence of coordinate geometry as a mathematical method as well as the growth of Calculus as a mathematical method characterized the process of transition from the classical mathematics as the new dawn within the history of modern mathematics (Pedoe, D. (1988). The importance of the coordinate axes is in order to fix a specific position of a given point within a plane. The point where these axes intersect is referred to as the origin and it is denoted by the symbol 0 (Pedoe, D. (1988). On normal occasions, the x-axis makes up the horizontal line while the y-axis makes up the vertical line.

3 The Ideology behind Analytical Geometry of Three Dimensions

A three dimensional coordinate system is usually constructed by ensuring that there is a z-axis that passes at a perpendicular angle to both the X-axis as well as the Y-axis at the point of origin of a Cartesian plane (ManualMaths. (2014). As earlier alluded to a point P in a three dimensional system is usually determined though an ordered system of (X,Y,Z) where X represents the distance directed from the YZ plane to point P, Y represents the distance directed from XZ plane to point P while Z represents the distance directed from XY plane to point P (ManualMaths. (2014) This is what helps us to explain how points are plotted within a three dimensional coordinated system.

In order to calculate the distance between different line segments that join points within space, the Distance Formula in Space is often used and this formula is written as;

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}\ .$$

On the other hand the Midpoint Formula in Space is used to calculate the midpoints of different line segments that join these points and it is given by the formula;

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$$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}, \frac{z_1+z_2}{2}\right).$$

The formula for a 3-dimensional space, where the midpoint between point (x_1, y_1, z_1) and point (x_2, y_2, z_2).

4 Applications of Analytical Geometry of Three Dimensions

Analytical Geometry of three dimensions tends to have very many different real life applications. One such application is in the field of chemistry where it is applied in order to help scientist understand the exact structure of a given crystal and a good example is the isometric crystals which are usually shaped as cubes (ManualMaths. (2014). In geography, the concept of analytical geometry of three dimensions is often used to graph equations that usually model surfaces that are in shape for example the earth surface which is spherical (ManualMaths. (2014). Other applications are in the fields of mechanical design, data analysis as well as in physics to determine tensions between different forces.

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