Analytic Geometry (Part 1) Lesson

2018-2019 SLSS Math Club

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1 Introduction

Analytic geometry, also known as coordinate geometry or Cartesian geometry, is the study of geometry using a coordinate system.

2 Formulas

2.1 Distance Formula

The distance between two points (x_1, y_1) and (x_2, y_2) is given by the following formula:

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

2.2 Midpoint Formula

The midpoint between two points (x_1, y_1) and (x_2, y_2) is given by the following formula:

$$M = (\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2})$$

2.3 Shortest/Perpendicular Distance

The shortest distance from a point (x_1, y_1) to a line $Ax + By + C = 0$ is given by:

$$d = \frac{|Ax_1 + By_1 + C|}{\sqrt{A^2 + B^2}}$$

3 Triangle Properties

3.1 Median

A line segment joining a vertex to the midpoint of the opposing side, bisecting it.

An linear equation of a median can be found by determining the midpoint of the opposite side and using the midpoint and the vertex as points to determine its $y = mx + b$ equation.

3.2 Altitude

A line segment that goes through a vertex and is perpendicular to the opposide side.

A linear equation of an altitude can be found by determining the slope of the opposite side and using its perpendicular slope along with the vertex to determine its $y = mx + b$ equation.

3.3 Right Bisector

A line that goes through a midpoint at a perpendicular angle.

A linear equation of a right bisector can be found by determining the slope and the midpoint of a given side and using its perpendicular slope and its midpoint to determine its $y = mx + b$ equation.

4 Practice

1. For ΔABC, for which its verticies are $A(1, 2)$, $B(4, 5)$, and $C(-2, 7)$, determine the following:

   (a) The perimeter of ΔABC

   (b) The linear equation of the median from A to side $\overline{BC}$

   (c) The linear equation of the altitude from B to side $\overline{AC}$

   (d) The linear equation of the right bisector from C to side $\overline{AB}$

2. Determine the perpendicular distance between the point $A(7, 1)$ and the line going through points $B(5, -2)$ and $C(2, 14)$