**Definition**

We define a **coordinate plane** to be represented by two perpendicular lines representing axes, and for their intersection to be the origin.

We define the distances of a point from the y and x axis to be the x and y **coordinates** of it respectively.

A line **perpendicular to a plane** $N$ is a line $X$ such that any line passing through the intersection point of $N$ and $X$ contained within plane $N$ is perpendicular to $X$.

We define **perpendicular planes** $N, M$ such that there is a line $X$ in plane $M$ such that $X$ is perpendicular to $N$.

**Notation**

A point shall be expressed $(x, y)$ in 2D, and $(x, y, z)$ in 3D. We run out of letters for higher dimensions, but we won’t be considering them in this handout.

**Formulas**

The shortest path from point $P$ to line $X$ is the perpendicular from $P$ to $X$.

The shortest path from point $P$ to plane $N$ is the perpendicular from $P$ to $N$.

The distance formula states that given $(x_1, y_1)$ and $(x_2, y_2)$, the distance of the two points is $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$.

The Shoelace Theorem states that given a polygon with coordinates $(x_1, y_1), (x_2, y_2)\ldots(x_n, y_n)$ listed in a clockwise or counterclockwise order, its area is $\frac{1}{2}|x_1y_2 + x_2y_3 + \ldots + x_ny_1 - x_1y_2 - x_2y_3 - \ldots - x_ny_1|$.

Pick’s Theorem states that given a non-self intersecting polygon with lattice coordinates, its area is $i + \frac{b}{2} - 1$ where $i$ denotes the amount of lattice points in the interior of our polygon and $b$ denotes the amount of lattice points on the boundary of our polygon.