



Chapter 1

The Coordinate System

Lesson 1

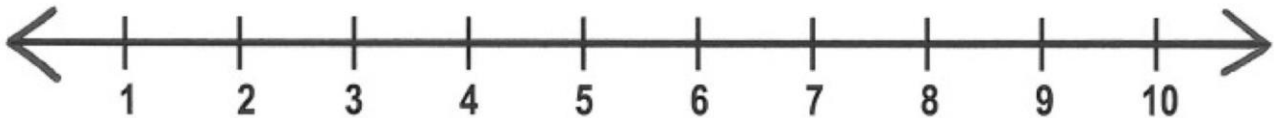
The Coordinate System

The goal of this lesson is to introduce basic aspects of space and shapes that can be built in this space.

Concepts

Most people understand space in 3 dimensions because that is the world we live in. Before seeing how to design in it, let's see how it is built:

The easiest way to define space is using the **number line** which is only one

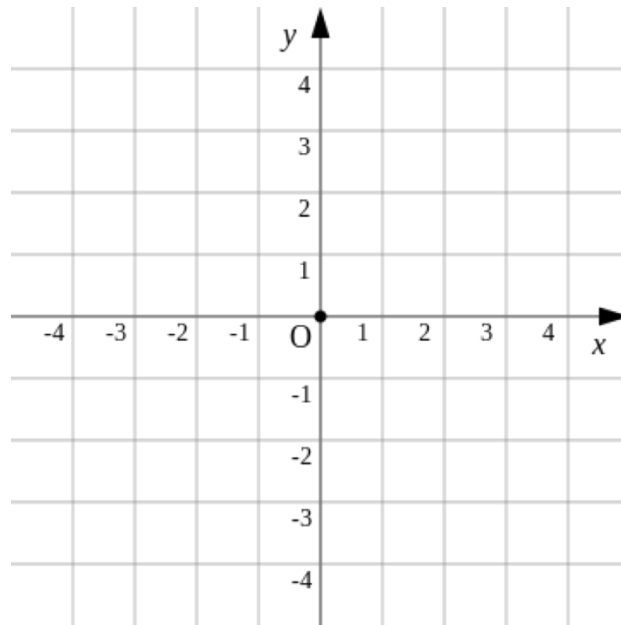


dimensional. The Number Line can hold positive and negative units.

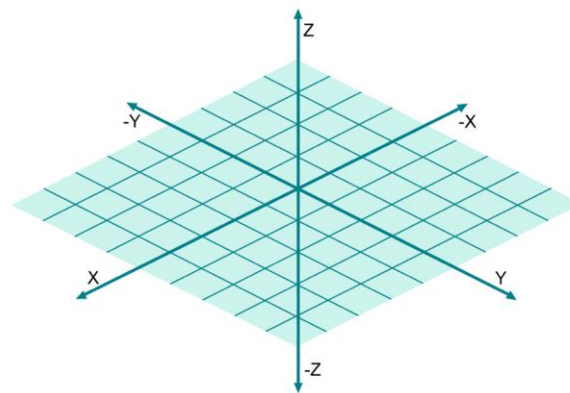
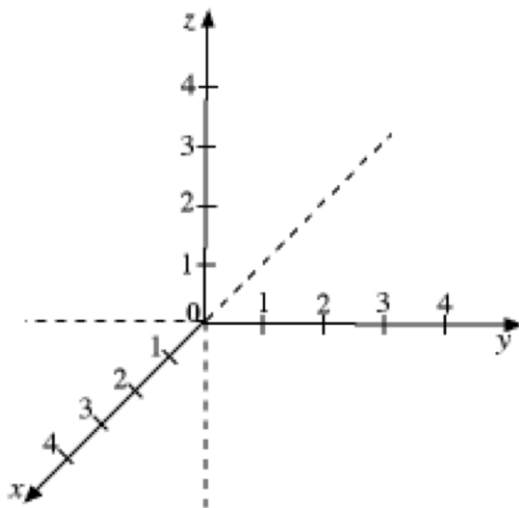
You can also create planes by arranging two number lines perpendicular to one another. However, this isn't the formal definition of a plane!



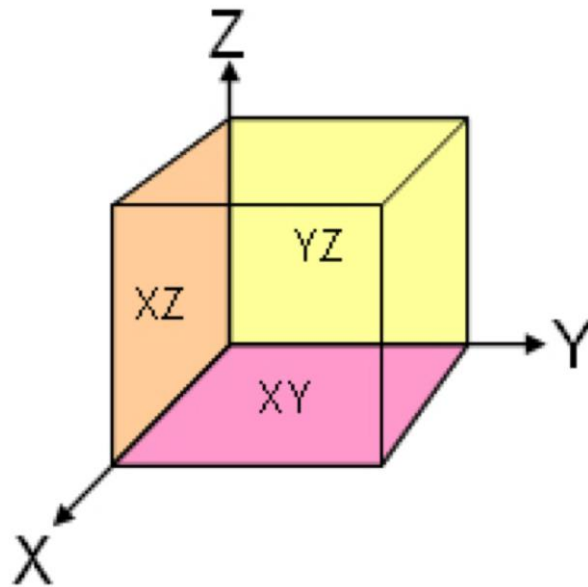
A plane is defined by three points, so while defining the x-y plane your three points are at $(0,0)$, $(0,x)$ and $(0,y)$ where x is any point on the X-Number-Line and y is any point on the Y-Number-Line.



In a similar manner, you can arrange three number lines to create a **3 dimensional space**. Each of the lines can point in any direction but they need to be perpendicular to one another.



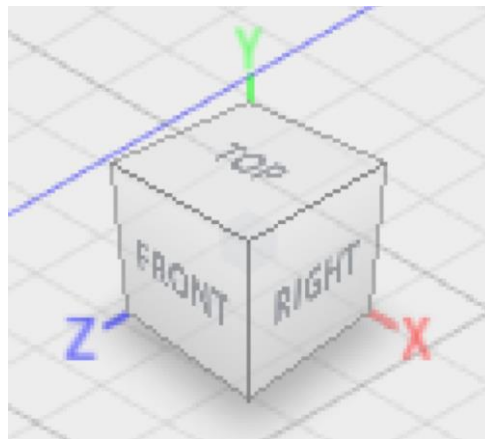
Here you can see three number lines and three planes:



The x-y-z planes arranged in this way create the Cartesian Coordinate System. **The “origin” is where the three planes intersect which is at (0,0,0).** As you know from your geometry class, **three planes intersect at a point!**

You also know that **when two planes intersect, you get a line.** For example, the x-z (orange) and y-z (yellow) planes intersect at the Z-Line.

You can think of the Cartesian Coordinates and the three planes in terms of a cube or a box, where the origin is at a corner, three edges coming out of the corner are your x, y, or z axes, and the faces

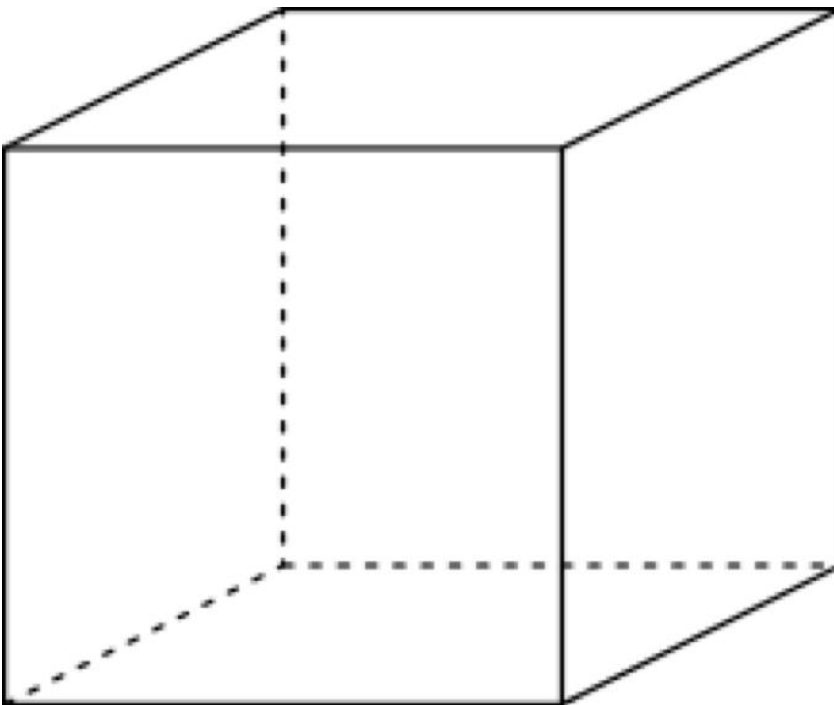


This is how Fusion360 labels it's space!

Now before we move on to the software, let's review what we just learned.

Exercises

1. Use the cube on the next page. First Label "Front", "Back", "Top", "Bottom", "Left" and "Right" on the cube. And then draw Cartesian Coordinates on this cube with the origin being at the bottom back corner.



2. Draw the Cartesian Coordinate system and mark the origin.

3. Draw a 3D coordinate system and mark $(2, -3, 0)$ $(5, 4, 2)$ and $(-4, -5, 1)$.