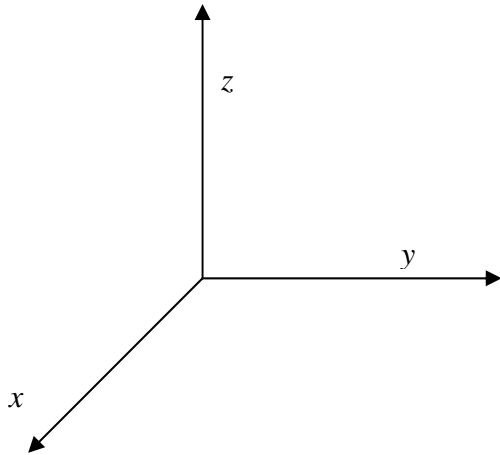


## Section 9.1 Three Dimensional Coordinate Systems

When we have an ordered triple  $(x, y, z)$  we locate it in space using three **coordinate axes**.



### Right Hand Rule

The three coordinate axes give rise to three **coordinate planes**.

The ordered triple  $(a, b, c)$  gives the distances to

$a$ :

$b$ :

$c$ :

### Cartesian Product

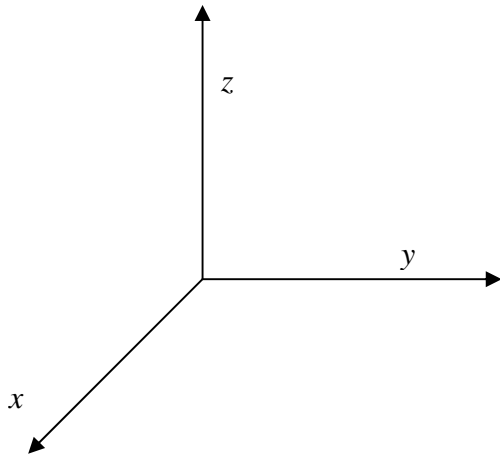
Three dimensional space is thus defined by the Cartesian product  $\mathbb{R} \times \mathbb{R} \times \mathbb{R} = \mathbb{R}^3$ .

## Surfaces

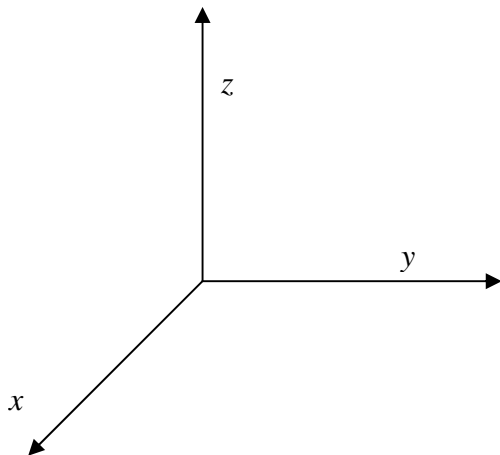
In three dimensional space an equation involving  $x$ ,  $y$ , and  $z$  will define a surface.

### Example 1

Sketch the surface given by  $y = 2$ .



Sketch the surface given by  $x + y = 2$ .



## Distance Formula in Three Dimensions

**Example 2**

Find the distance from  $(2, -1, 5)$  to  $(-1, 3, 4)$ .

**Example 3**

Find the equation of a sphere of radius 5 with center  $(2, 5, 3)$ .

**General Form of a Sphere of radius  $r$  and center  $(h, k, l)$ .**

**Example 4**

Find the center and radius of the sphere  $x^2 + y^2 + z^2 - 2x + 4y - 6z + 6 = 0$

**Example 5**

What region in  $\mathbb{R}^3$  is given by  $1 \leq x^2 + y^2 + z^2 \leq 9$  with  $z \geq 0$ ?

**HW 9.1 # 1, 3, 7, 8, 9, 11, 15, 23, 25, 27, 29, 35**