2-Dimensional Coordinate System

2 perpendicular coordinate axes (x and y)

Intersection O is called the origin.

Coordinate axes divide the plane into 4 Quadrants.

A point in the (2D) plane is given by an ordered pair (a, b).

Cartesian Product (Notation)

$\mathbb{R} \times \mathbb{R} = \mathbb{R}^2 = \{(x, y) | x, y \in \mathbb{R}\}$

3-Dimensional Coordinate System

3 perpendicular coordinate axes (x, y and z)

Intersection O is called the origin.

Coordinate _____ divide the _____ into _____ .

A point in the (3D) space is given by an ordered triplet (a, b, c).

Cartesian Product (Notation)

$\mathbb{R} \times \mathbb{R} \times \mathbb{R} =$ _____ $= \{(x, y, z) | x, y, z \in \mathbb{R}\}$

2-Dimensional Coordinate System

Sketch the graphs of the following equations.

(a). $y = 3$

(b). $y = x$

(c.) $x^2 + y^2 = 4$

Graphs of equations in $\mathbb{R}^2$ represent _____ .

3-Dimensional Coordinate System

Sketch the graphs of the following equations.

(a). $y = 3$

(b). $y = x$

(c). $x^2 + y^2 = 4$

Graphs of equations in $\mathbb{R}^3$ represent _____ .

Ex Sketch $y + z = 4$ in $\mathbb{R}^3$.

Def Given 2 points $P_1(x_1, y_1, z_1)$ and $P_2(x_2, y_2, z_2)$ in space, the distance between them is given by

Ex Find the distance from the point $(3, 7, -5)$ to the

(a). point $(1, -4, 8)$ **(b).** $xz-$plane **(c).** $z-$axis

Ex Three points A, B, and C lie on the same line if and only if _____ .

Def A _____ is the set of all points in $\mathbb{R}^3$ that are _____ from a point C.

Note: r is called the _____ . The point $C(h, k, l)$ is called the _____ .

Ex Find the equation of a general sphere with radius r and center (h, k, l).

Ex Given center $C(3, 4, -1)$ and radius $r = \sqrt{5}$,

(a). Find the equation of the sphere.

(b). Describe the intersection of the sphere with the **(i)** $xy-$plane. **(ii)** $yz-$plane.

Ex Describe the region in $\mathbb{R}^3$ given by $x^2 + 2x + y^2 \leq 3$.

Ex Write an inequality to describe the region inside the top half of the sphere with radius 3 and centered at $(1, 1, 2)$.