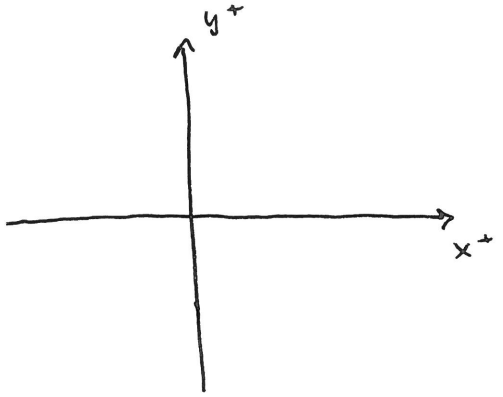
Section 12.1 - 3D Coordinate System

MVC

- 2D - Cartesian Coordinate System



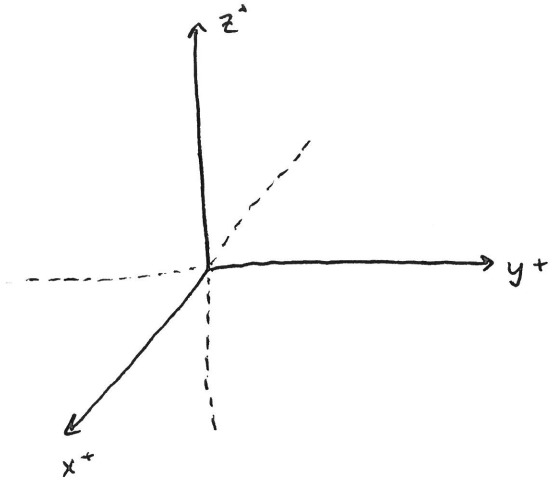
Point:

Sketch: (3,2)

Set:

Equations:

- 3D - Coordinate system



Point:

Sketch: (3,2,1)

Set:

Equations:

Example 1 What surfaces in $\mathbb{R}^3$ are represented by the equations:

(a) $z = 3$

(b) $y = 5$

★ Visit: www.math.uri.edu/~bkaskosz/flashmo/graph3d2/

- Distance Between two Points P_1 & P_2:

$\mathbb{R}^2$: $P_1(x_1, y_1)$ $P(x_2, y_2)$

$D =$

$\mathbb{R}^3$: $P_1(x_1, y_1, z_1)$ $P_2(x_2, y_2, z_2)$

$D =$

Example 2 (a) Which points (x, y, z) satisfy $x^2 + y^2 = 1$ and $z = 3$? Sketch
(b) What does the equation $x^2 + y^2 = 1$ represent in $\mathbb{R}^3$? Sketch

- Equation of a sphere:

Recall: A circle is the set of all points in $\mathbb{R}^2$ equidistant from the center.
A sphere is the set of all points in $\mathbb{R}^3$ equidistant from the center.

Circles:

Radius r; center O

Radius r; center P
$P(h, k)$

Spheres:

$P(h, k, l)$

Example Show $x^2 + y^2 + z^2 = -4x$ is the equation of a sphere. Sketch

Example 7 What region in $\mathbb{R}^3$ is represented by $1 \leq x^2 + y^2 + z^2 \leq 4$ and $z \leq 0$? Sketch

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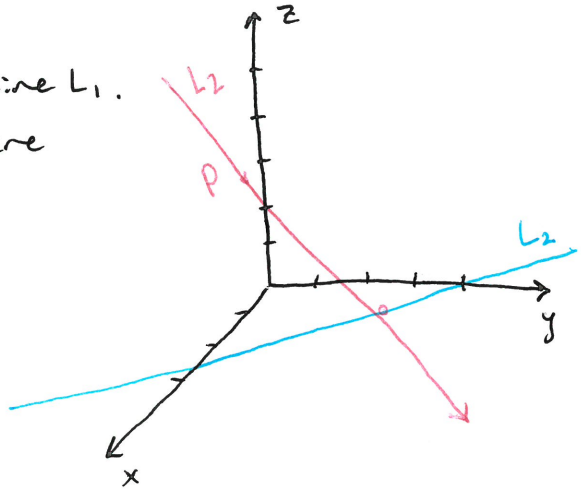
- Extra Examples:

39. The figure shows a line L_1 in space, a second line L_2 is the projection of L_1 onto the xy-plane.

(a) Find the coordinates of the point P on the line L_1.

(b) Locate on the diagram the points A, B, C where L_1 intesects the xy, yz, zx planes.



41. Find an equation of the set of all points equidistant from the points A(-1, 5, 3) and B(6, 2, -2). Describe the set.

43. Find the distance between the spheres $x^2 + y^2 + z^2 = 4$ and $x^2 + y^2 + z^2 = 4x + 4y + 4z -$