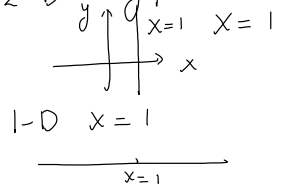
11.1 3-D coordinate system:

2-D: xy plane



1-D $x = 1$

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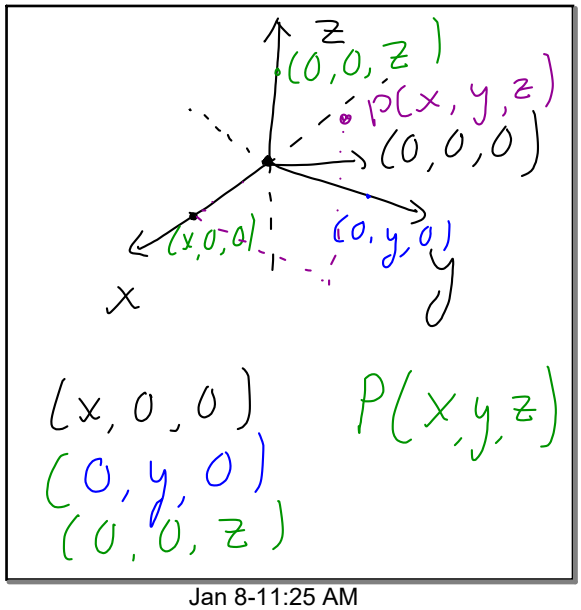

$(x, 0, 0)$ $P(x, y, z)$

$(0, y, 0)$

$(0, 0, z)$

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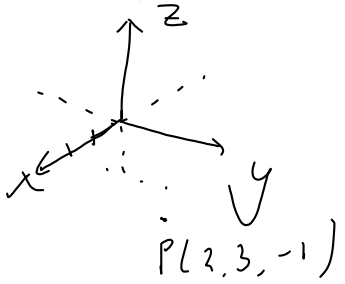
Ex) $P(2, 3, -1)$



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(1) $X = 1$ in 3-D plane perpendicular to x-axis and parallel to y and z-axis.

(2) $y = -3$

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(3) $x^2 + y^2 = 4, \; z = 0$

$x^2 + y^2 = 4, \; z = 3$

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Distance between two points in space:

Def^n: The distance between $P_1(x_1, y_1, z_1)$ and $P_2(x_2, y_2, z_2)$ is given by

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$$|P_1P_2| = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2+(z_2-z_1)^2}$$

(ex) $P(3, 1, 0)$

$Q(-1, 2, -5)$

$$|PQ| = \sqrt{(-1-3)^2+(2-1)^2+(-5-0)^2} = \sqrt{16+1+25} = \sqrt{42}$$

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Equation of a sphere:

The equation of a sphere with radius r and center (h, k, l) is given by

$$(x-h)^2+(y-k)^2+(z-l)^2 = r^2$$

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(Ex)

$$(x+2)^2+(y+1)^2+(z-2)^2 = 9$$

Center: $(-2, -1, 2)$

radius: 3

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(Ex)

Determine if

$$x^2+y^2+z^2-10x+2y+8z = 9$$

represents a sphere.

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$$x^2-10x+25+y^2+2y+1+z^2+8z+16 = 9+25+1+16$$

$$(x-5)^2+(y+1)^2+(z+4)^2 = 51$$

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Center: $(5, -1, -4)$

radius: $\sqrt{51}$

$$x^2+y^2+z^2 = 25$$

$$x^2+y^2+z^2 \leq 25$$

$$x^2+y^2+z^2 > 25$$

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