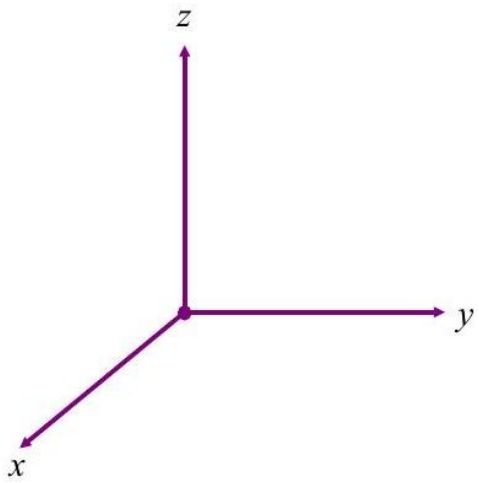
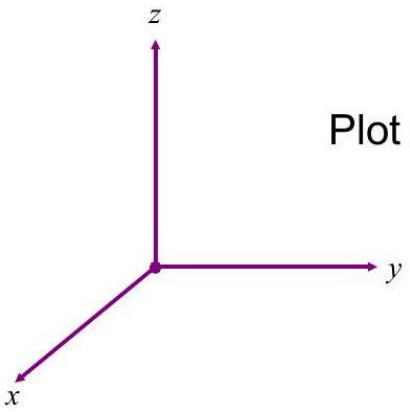
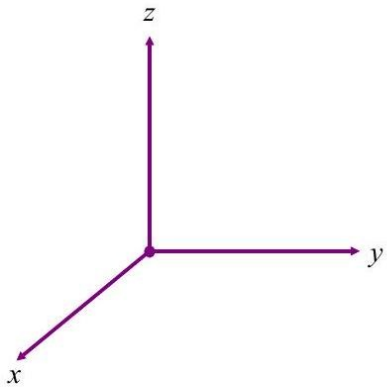
Math 2210 #2
Cartesian Coordinates in 3-Space

A point in 3 -space is given by an ordered triple (x, y, z).



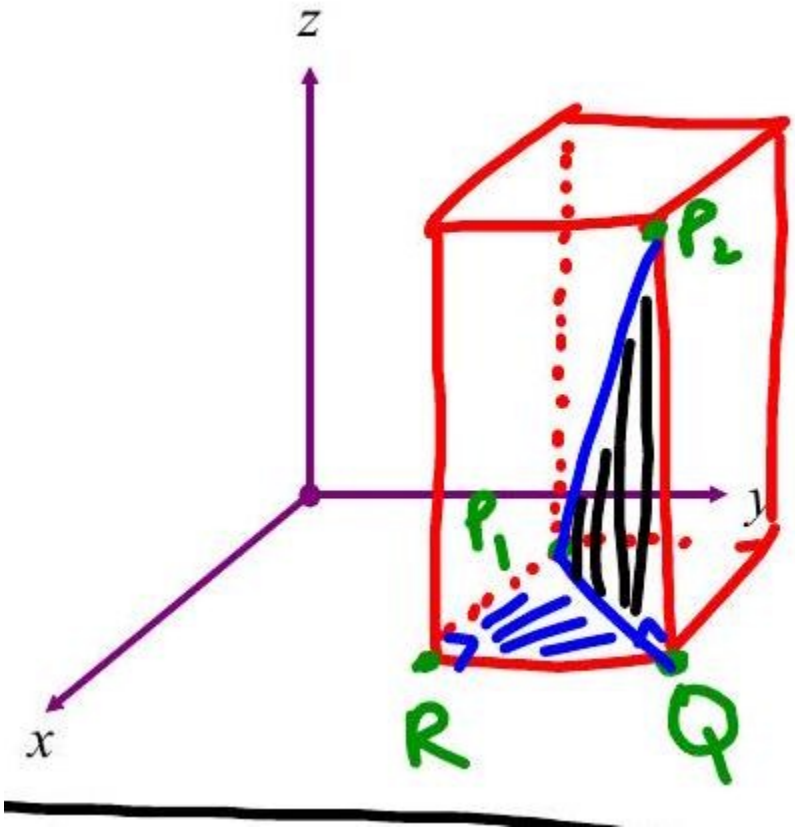


Plot (*2,3,4*)



Plot (*-1,4,-3*)

Distance Formula $d^2 = (\Delta x)^2 + (\Delta y)^2 + (\Delta z)^2$



note: P_1Q means length of line segment from P_1 to Q

$\triangle P_1P_2Q$ and $\triangle P_1QR$ are both right triangles.
⇒ can use Pythagovean Thm $|P_1Q|^2 + |QP_2|^2 = |P_1P_2|^2$ (1)
and $|P_1R|^2 + |RQ|^2 = |P_1Q|^2$ (2)
⇒ sub (2) into (1)

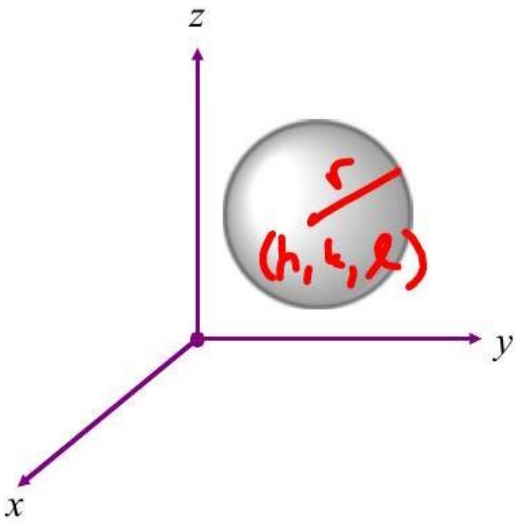
EX 1

Show that these points are vertices of an equilateral triangle.

(4,5,3), (1,7,4), (2,4,6)

Spheres All points (x, y, z) on a sphere are a fixed distance, r from the center.

$$r = \sqrt{(x-h)^2 + (y-k)^2 + (z-l)^2}$$



So the equation of a sphere with radius r and center (h, k, l) is

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

Midpoint of the segment (x_1, y_1, z_1) and (x_2, y_2, z_2)

$$m = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2}\right)$$

EX 2

2a)

Find the center and radius of this sphere.

$$x^2 + y^2 + z^2 + 2x - 6y - 10z + 34 = 0$$

2b)

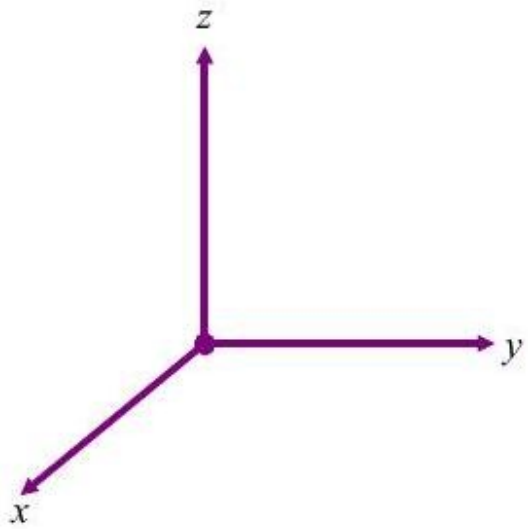
Find the equation of the sphere that has a diameter from (-4,2,1) to (8,3,6).

Linear equations in 3-space

$$Ax + By + Cz = D$$

EX 3

Graph $3x - 4y + 2z = 24$.



EX 4

Graph $3x + 4y = 12$.