2. Determine if the equation is a sphere. Find its center and radius.

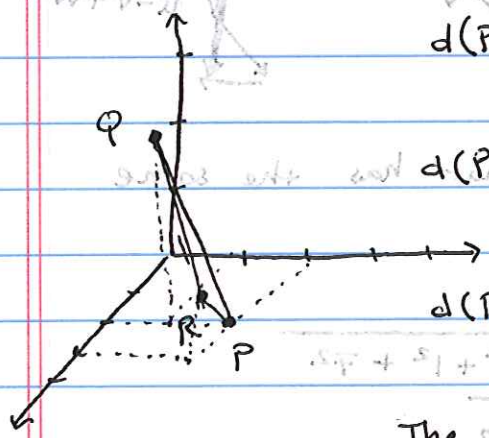
$$x^2 - 4x + y^2 - 2y + z^2 - 6z = -10$$

Solution: $\Rightarrow x^2 - 4x + 4 + y^2 - 2y + 1 + z^2 - 6z + 9 = 4 + 1 + 9 - 10$

$\Rightarrow (x-2)^2 + (y-1)^2 + (z-3)^2 = 4$

- It's a sphere
- radius is 2
- center is $(2, 1, 3)$

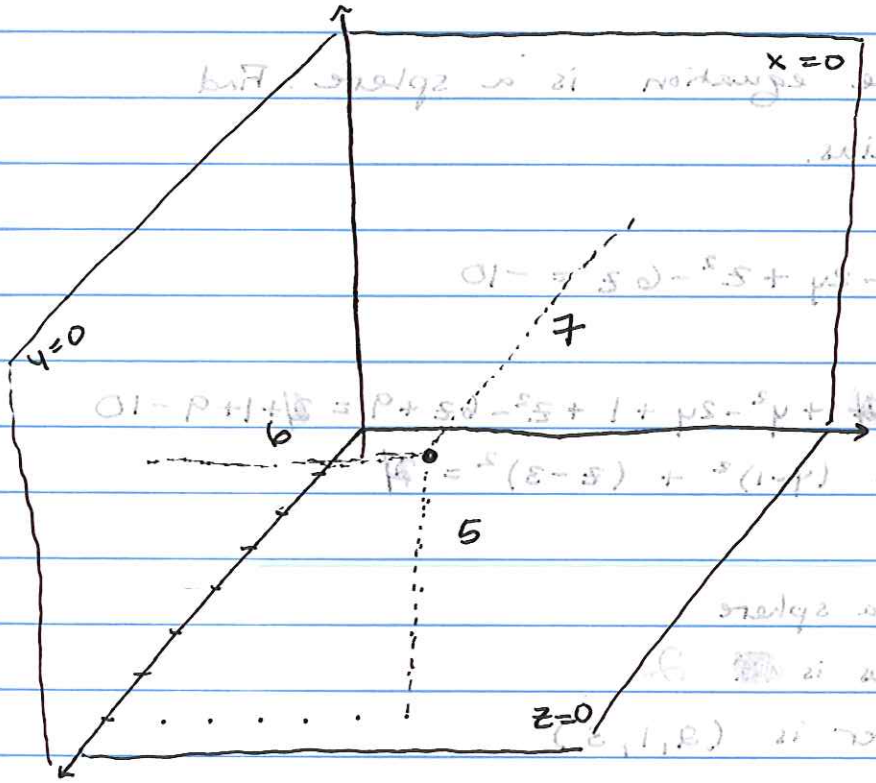
3. Consider the triangle $P(2,2,0)$, $Q(2,1,3)$ and $R(3,2,1)$. Determine if it is equilateral, isosceles, or scalene.



$$d(P,R) = \sqrt{(2-3)^2 + (2-2)^2 + (0-1)^2}$$
$$= \sqrt{2}$$
$$d(P,Q) = \sqrt{(2-2)^2 + (2-1)^2 + (0-3)^2}$$
$$= \sqrt{10}$$
$$d(R,Q) = \sqrt{(3-2)^2 + (2-1)^2 + (1-3)^2}$$
$$= \sqrt{6}$$

The triangle is scalene.

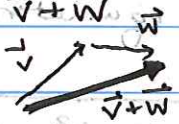
4.



The shortest distance is 5. Therefore, the largest radius we can get without leaving the first octant is 5.

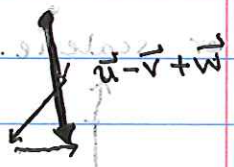
5. Add the vectors

a.) $\vec{v}+\vec{w}$



b.) $\vec{v}-\vec{w}$

c.) $\vec{u}-\vec{v}+\vec{w}$



6. Find the unit vector that has the same direction

(a) $\langle 4,1,7\rangle$

$$|\langle 4,1,7\rangle| = \sqrt{4^2+1^2+7^2}$$

$$= \sqrt{66}$$

Solution: $\left\langle \frac{4}{\sqrt{66}}, \frac{1}{\sqrt{66}}, \frac{7}{\sqrt{66}} \right\rangle$

(b) $8\vec{i}-2\vec{j}+10\vec{k} = \langle 8,-2,10\rangle$

$$\sqrt{8^2+(-2)^2+10^2} = \sqrt{168}$$

Solution: $\left\langle \frac{8}{\sqrt{168}}, \frac{-2}{\sqrt{168}}, \frac{10}{\sqrt{168}} \right\rangle = \left\langle \frac{4}{\sqrt{42}}, \frac{-1}{\sqrt{42}}, \frac{5}{\sqrt{42}} \right\rangle$

7. Find $\overrightarrow{AB}$.

a. $A(0,0,0)$, $B(1,2,1)$

Sol: $\overrightarrow{AB} = \langle 1-0, 2-0, 1-0 \rangle$

$= \langle 1, 2, 1 \rangle$

b. $A(1,2,12)$, $B(0,0,0)$

Sol: $\overrightarrow{AB} = \langle 0-1, 0-2, 0-12 \rangle$

$= \langle -1, -2, -12 \rangle$

c. $A(1,0,20)$, $B(40,1,1)$

Sol: $\overrightarrow{AB} = \langle 40-1, 1-0, 1-20 \rangle$

$= \langle 39, 1, -19 \rangle$

8.) Find $\vec{v} + \vec{w}$ and $\vec{w} - \vec{v}$

$\vec{v} = \langle 2, \sqrt{2}, \pi \rangle$, $\vec{w} = \langle -7, \sqrt{3}, \frac{\pi}{2} \rangle$

Solution:

$\vec{v} + \vec{w} = \langle -5, \sqrt{2} + \sqrt{3}, \frac{3\pi}{2} \rangle$

$\vec{w} - \vec{v} = \langle -9, \sqrt{3} - \sqrt{2}, -\frac{\pi}{2} \rangle$