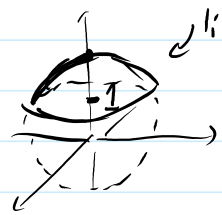
HW1 key

Monday, January 14, 2019 3:32 PM

1) a) the vertical line through $(4,1,0)$
   b) the sphere of radius $\sqrt{3}$ with center $(0,0,2)$
   c) the top slice of the sphere of radius 2 above $z=1$



like this

2) a) $\sqrt{(0-2)^2+(1-3)^2+(0-4)^2} = \sqrt{4+4+16} = \sqrt{24} = 2\sqrt{6}$

   b) $\sqrt{(-2-1)^2+(-1-1)^2+(3-1)^2} = \sqrt{9+4+4} = \sqrt{17}$

   c) $\sqrt{0^2+0^2+(2-4)^2} = 2$

3) $4x^2+4y^2+4z^2-4x+8y+16z-13=0$

$4(x^2-x)+4(y^2+2y)+4(z^2+4z)=13$

$(x^2-x+\frac{1}{4}-\frac{1}{4})+(y^2+2y+1-1)+(z^2+4z+4-4)=\frac{13}{4}$

$(x-\frac{1}{2})^2-\frac{1}{4}+(y+1)^2-1+(z+2)^2-4=\frac{13}{4}$

$(x-\frac{1}{2})^2+(y+1)^2+(z+2)^2=\frac{13}{4}+\frac{1}{4}+1+4=\frac{34}{4}=\frac{17}{2}$

radius $\sqrt{\frac{17}{2}}$

center $(\frac{1}{2},-1,-2)$

4) $x^2+y^2+z^2-4x+2y-4z+9=0$

$(x^2-4x)+(y^2+2y)+(z^2-4z)=-9$

$(x^2-4x+4-4)+(y^2+2y+1-1)+(z^2-4z+4-4)=-9$

$(x-2)^2-4+(y+1)^2-1+(z-2)^2-4=-9$

$(x-2)^2+(y+1)^2+(z-2)^2=-9+4+1+4=0$

radius of 0 means this isn't a sphere, but the point $(2,-1,2)$.

5) $0\le x\le 6,\ 0\le y\le 6,\ 0\le z\le 6$

6) distance from $(3,4,5)$ to $(3,0,0)$ is $\sqrt{0^2+4^2+5^2}=\sqrt{41}$

7) distance from $(2,-1,1)$ to $(0,-1,0)$ is $\sqrt{2^2+1^2}=\sqrt{5}$

8) a) $\overrightarrow{PQ}=\langle 4-1,\ 5-2,\ 6-3\rangle=\langle 3,3,3\rangle$. $|\overrightarrow{PQ}|=\sqrt{9+9+9}=\sqrt{27}=3\sqrt{3}$
   b) $\overrightarrow{PQ}=\langle 2-0,\ 1-1,\ 0-1\rangle=\langle 2,0,-1\rangle$. $|\overrightarrow{PQ}|=\sqrt{4+0+1}=\sqrt{5}$
   c) $\overrightarrow{PQ}=\langle 1-1,\ 0-0,\ 2-3\rangle=\langle 2,0,-1\rangle$. $|\overrightarrow{PQ}|=\sqrt{5}$ again.

9) b & c are equal

10) any scalar multiple of $\langle -2, 2, -5\rangle$

11) $\vec{v} = k\langle -8, 1, 4\rangle$ will work when k is positive. We need $|\vec{v}| = 3$, so we must have

$3 = \sqrt{(-8k)^2 + (1k)^2 + (4k)^2}$

$9 = 64k^2 + k^2 + 16k^2$

$9 = 81k^2$

$1/9 = k^2$

we want the positive k; so, $k = 1/3$ and the desired vector is

$\vec{V} = \langle -8/3, 1/3, 4/3\rangle$

12) $\vec{v} = \langle 2, -1, 3\rangle$. $|\vec{v}| = \sqrt{4+1+9} = \sqrt{14}$, so the unit vector is $\vec{u} = \langle \frac{2}{\sqrt{14}}, \frac{-1}{\sqrt{14}}, \frac{3}{\sqrt{14}}\rangle$

13) $\vec{u} = \langle 2, 3\rangle$ $\vec{v} = \langle -1, 2\rangle$

a) $\vec{u} + \vec{v} = \langle 2-1, 3+2\rangle = \langle 1, 5\rangle$

b) $3\vec{u} = \langle 6, 9\rangle$

c) $2\vec{u} - 3\vec{v} = \langle 4, 6\rangle + \langle 3, -6\rangle = \langle 7, 0\rangle$

14) $P = (-1, 2, -3)$. $Q = (1, 3, 5)$. So, midpoint is $\left(\frac{1+-1}{2}, \frac{2+3}{2}, \frac{-3+5}{2}\right) = \left(0, 5/2, 1\right)$